

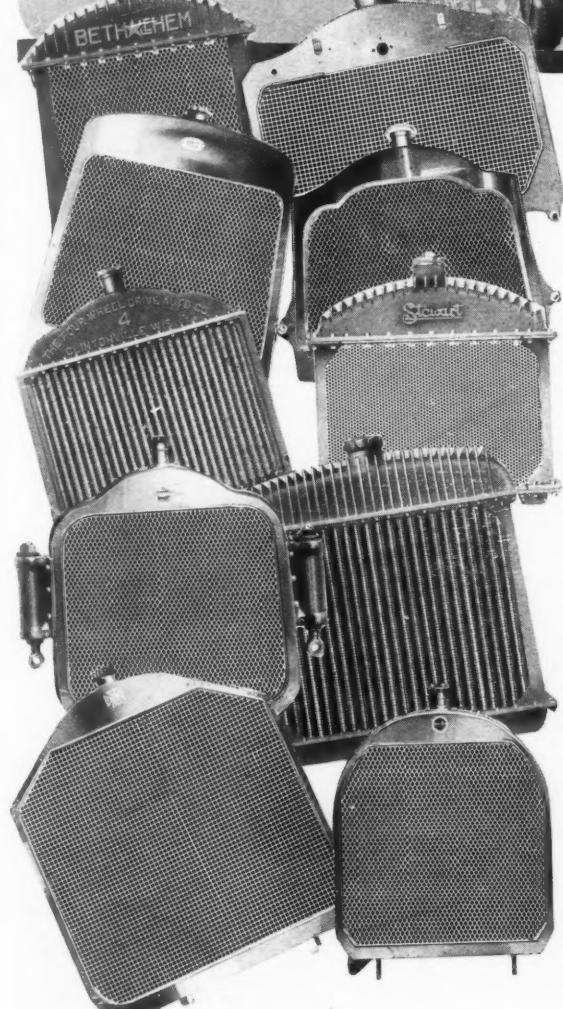
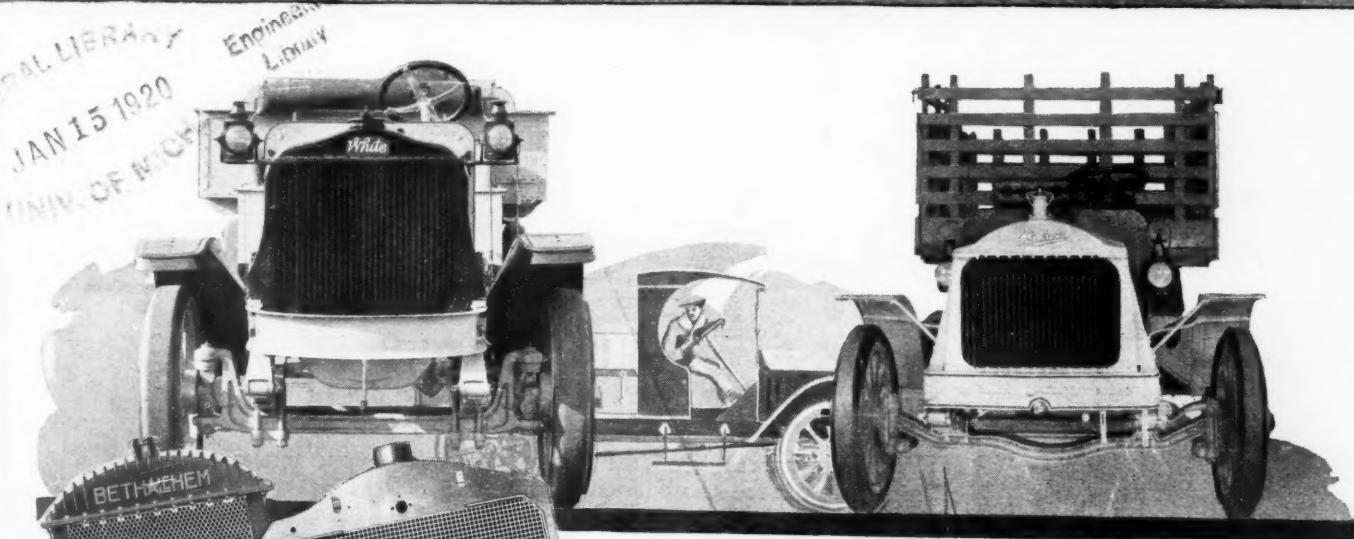
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The AUTOMOBILE

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Number 26

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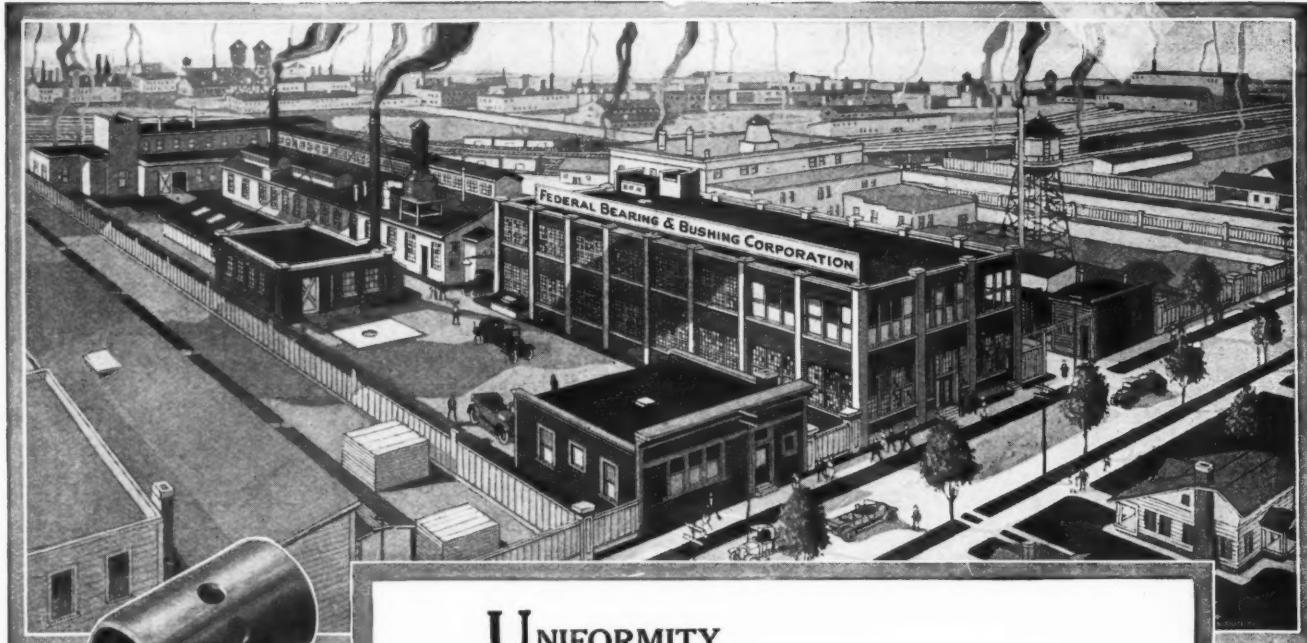
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AUTOMOTIVE INDUSTRIES

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VOL. XLI

NEW YORK—THURSDAY, DECEMBER 25, 1919—CHICAGO

No. 26

A Financier's View of Profit Sharing

It is interesting to note in this article by Mr. Schiff the banker's view of one of the labor movements which, while it has been successfully established in individual plants, has only recently attracted general attention. Three points are especially notable: The insistence upon a well grounded understanding, the inclusion of officers and directors, and the form of payment.

By Mortimer L. Schiff

IN the discussions now taking place as to the relationship which should exist between capital and labor, much stress is being laid on the establishment of true partnership.

It needs surely no argument to prove that this is desirable, but it can exist only if there is real understanding of each other's problems.

It must be based on mutual good-will and confidence and there must be unreserved co-operation between employer and employee.

In any scheme of industrial democracy, the worker should have a voice in determining the conditions of his employment; there should be insurance, pension and benefit plans; there must be contentment, based on proper working conditions and there should be participation by the worker in the results of the enterprise, so that his interests and those of his employer may as far as possible become identical.

It is to this last phase of this important subject that I am addressing myself; and in discussing it I am doing so, as a matter of convenience, in the terms of corporate enterprises, but what I have to say is just as applicable to those privately owned.

There can be no true partnership if either element has an unfair advantage over the other.

There must be no secrets as to the results of the operations of the business, there must be full disclosure, so that the worker knows he is getting his full share and that it is thus to his interest to secure the maximum results.

There must be no paternalism, no interference with the personal liberty of the employee, no savoring of philanthropy or of charity.

As Mr. William Cooper Proctor, President of the Proctor & Gamble Co., has well said in a recent article:

"No one can build a sound profit-sharing plan on the desire to make money.

"You must be possessed of the conviction, not only that a fair share of the profit existing without the profit-sharing plan belongs to the worker, but that under the profit-sharing plan the worker will produce enough additional to pay profit-sharing dividend.

"Your interests must be primarily in the men and seeing that they have the opportunity of earning, through increased interest, the additional money; and, above all, you must realize that it is

more than money that the men want, it is a sense of ownership, that can be, in part at least, developed through profit-sharing.

"Without this unselfish motive on the part of the employer, profit-sharing will never be a success, for both he and the men, in the end, will distrust each other and be dissatisfied with any distribution made."

Profit-sharing might well be called savings-sharing, as in the final analysis, it is the economies in operation and the increase in production resulting from a real participation by the workers in the fruits of their industry, which will make available the profits to be shared.*

Theoretically the ideal situation would be a wage scale fluctuating with the earnings of the enterprise, just as the return on the capital invested is dependent on the profits realized.

This is of course not feasible, but in considering plans for the establishment of industrial partnership, it must not be overlooked—

First, that the respective positions of capital and labor are not parallel, and

Secondly, that capital does not necessarily represent wealth, but is often made up of the contributions of many people of moderate means, who also, like the wage earner, are dependent on the income they receive.

The stockholder takes all the risk; he can earn a return on his investment only if the business is profitable and even in that case must frequently do without dividends, so as to strengthen the enterprise by re-investing its earnings.

The employee, on the other hand, receives his compensation as a first charge on the business, his salary or wage forms part of the operating expenses and must be paid even before interest on borrowed money.

The primary return to labor is practically guaranteed, while that to capital is dependent on the results achieved.

It is apparent that there can be no partnership which does not recognize these factors, and that any scheme of profit-sharing, if it is to be effective, must provide that the profits or surplus income to be dealt with shall be those remaining not only after payment of adequate salaries and wages, but also after a fair return to the stockholders and the setting up of proper reserves.

STOCK SUBSCRIPTION

Profit-sharing must not be confounded with stock subscription plans and bonus systems.

Desirable and advantageous as these sometimes are to the employees, they cannot replace a real and continuing interest in the earnings of an enterprise, fluctuating year by year in proportion to the results achieved.

The payment of a cash bonus at more or less regular intervals becomes in time simply an additional wage, to which the worker is certain to adjust his living expenses, and therefore does not induce saving or encourage thrift. The temptation is too great to spend it as it comes in.

In addition, if it is fixed, as is usually the case, at an arbitrary figure, it is bound to give the worker the feeling that he is not getting his full share and that he is not really participating in the profits of the business.

A pure stock subscription plan is simply giving the employee a chance to invest, with the privilege of paying in instalments.

Unless there is added to the annual return on the stock he thus acquires a special dividend, because he is an employee, there is no participation by him in the earnings of the company beyond that accruing proportionately to any other stockholder.

A plan, such as is in operation in a number of companies, by which he receives special dividends, which helps him to pay for the stock, has much to be said in its favor, but hardly accomplishes the same result as one which pays him at regular intervals his share of the profits in a suitable form and leaves it to his own determination whether to convert it into a stock interest.

The one is compulsory investment in the stock of the company as a condition of participation in the distribution, the other leaves to him his freedom of action and of decision.

There appears to be no more justification in saying to the employee, "we shall give you a share of the profits if you will invest it in the stock of the company," than to say to the stockholder, "you will receive an extra dividend if you will use it to buy more stock."

PROFIT SHARING

Profit-sharing is not a cure-all, nor desirable as it is, is it applicable to every type of industry, but where it is feasible, a properly worked out plan, fair to all concerned, will do much towards establishing sound relations between capital and labor, and through the participation by the employees in the earnings, give them a real interest to stimulate production and reduce operating costs.

The present high cost of living is due, to a considerable extent, to under-production, and this is bound to be the case as long as the employees think it more advantageous to have minimum working hours with maximum wages.

It is perhaps for this reason that organized labor has on the whole not been favorably disposed towards profit-sharing. They have apparently feared that it would take the place of adequate compensation and of proper working conditions.

Any sound scheme of profit-sharing must be supplemental to this and must be based on there first being a proper return to both labor and capital. The failure of many plans has been due primarily to this requisite having been overlooked.

An inequitable distribution, an insufficient and not appreciable share in the profits, or frequent payments of bonuses in cash, which are eventually considered as part of the wages and therefore resented if not paid, are bound to result in the failure of any profit-sharing plan, no matter how honestly it may be conceived.

Of course, it is axiomatic that there can be no profit-sharing if there are no profits, and no enterprise should adopt such a plan unless it is reasonably certain that there will be substantial surplus income to distribute.

The distribution must be without discrimination to all employees, but they must be properly classified, so that it may be measured, as far as practicable, by the employee's relative contribution towards profit-making.

The basis of division must be definite, but the amount must vary in proportion to the profits realized.

Needless to say, in case employees leave the service they must have no claim on the accumulated income of the corporation, and the accounts must not be subject to their control or direction.

It must be left to the judgment of those managing the enterprise, subject of course to the rules and regulations of governmental agencies, to determine what should be charged to capital and what to operating expenses, and what reserves are to be set up.

Most important of all, the distribution should be in such a form as to lead to the encouragement of thrift, of continuity of employment and of an eventual interest in the property. Thus will efficiency, economy and true partnership be promoted.

It may be argued against profit-sharing that men working in different concerns, but in a similar capacity, will receive different rewards for the same class of work, because one happens to be employed by a successful employer and another by one who makes but meagre profits, insufficient to permit of a distribution.

That is true, but after all that is one of the inequalities of opportunity which are bound to exist, no matter how we may try to prevent them.

Even so, the hardship is not a great one, if profit-sharing plans are predicated on and are supplemental to adequate compensation.

It should be borne in mind, however, that profit-sharing is primarily applicable to and suitable for manufacturing

and producing concerns, where there is a direct relation between the worker and the goods produced.

It is not so easily adapted to enterprises such as public service corporations, where the rates received are fixed by law and the service rendered by the employees is more arbitrarily defined.

In my opinion, the salaried officers should participate in any profit-sharing plan, and it should not be restricted, as in most proposals appears to be the case, to those working for a daily wage.

It might possibly be advisable to include even the members of the Board of Directors who are, after all, the highest officials, rendering important services. They are frequently not large shareholders and receive under our prevailing system but nominal compensation for their services—contrary to the practice of most of the other leading countries.

We can learn much from the so-called "tantième" system, prevalent in many European countries, which provides that after a certain statutory dividend has been paid, a definite percentage of the surplus profits remaining is passed to reserves (with the right to the Board of Directors to make additional appropriations for reserves, not exceeding a certain amount), then a definite percentage goes to the higher officials and to the Board of Directors and the final balance is available for extra dividends to the stockholders.

They have gone to an extreme in giving those directing the enterprise a share in the results and in most cases have apparently overlooked the fact that the general run of employees are also in a position to make a material contribution to its success and should, therefore, receive consideration.

Another feature in their system, which seems inadvisable, is that the distribution is in cash and thus becomes simply additional compensation. A combination of the two plans, providing for both officers and employees, appears to be the soundest proposition and the one which should be followed.

All who contribute towards the success of an enterprise should have the opportunity to participate.

The basis of a profit-sharing plan is comparatively simple.

It must deal only with the surplus remaining after all operating and fixed charges, including adequate salaries and wages, have been met, after provision has been made for statutory and extraordinary reserves and after a fair return has been paid to the stockholders on their investment.

This surplus should be divided in an agreed definite percentage between the officers and employees and the stockholders. The amount accruing to the stockholders should be added either to the surplus account and thus become an additional investment on their part in the property, or distributed to them, in whole or in part, as extra dividends, as may be determined by the management of the enterprise.

The amount accruing to the employees should be distributed to all officers (including possibly members of the Board of Directors) and employees who have been in the service for a specified period, with a larger percentage to those receiving small salaries and wages and to those longer in the service.

The officers and employees should be classified according to the salaries they receive and the service they render and these in turn according to length of service, so that a proper distribution can be made.

A table should be issued showing what each one in each classification would receive, on the basis of some definite sum distributable, so that it could then be easily figured by each one what he is to receive when the announcement of the distributable amount is made.

The real crux of the situation is what form the distribution should take.

It should not be in cash, as this is almost certain to be of no permanent advantage to the employee and does not assist him in securing a permanent interest in the property.

It should be in the form of some security, which it is to his interest to hold.

I suggest non-negotiable, registered, convertible 6 per cent debentures, convertible into cash at the option of the holder after a certain period, say three years, but even during that

period redeemable by the company in case the holder leaves its service.

I feel convinced that if the employees once get the habit of holding them, either in their original form or converted into stock of the company, they will, except in case of emergency, continue to do so and thus accumulate a real reserve fund for themselves and their families.

As an additional encouragement to thrift and as a reward for continuity of employment, I suggest that the debentures be cashable at a premium on an ascending scale, dependent on the length of time they have been held and the holder has remained in the employ of the company.

For instance, it might well be provided that their cash value should be 102½ per cent after five years, and 105 per cent after ten years and thereafter.

The greatest handicap to industrial economy and efficiency is shifting employment, not only on account of the expense and waste which this entails, but even more so because of its effect on the quality of service rendered. There can be no economy and real efficiency unless the workers feel that their efforts have a real relation to the success or failure of the enterprise with which they are connected.

As a precautionary measure, the company should reserve the right to require, say, sixty days' notice of the intention of the holder to convert his debentures into cash.

As in the case of savings banks, this right would probably be rarely, if ever, availed of, but it is a necessary protection against times of crisis or of acute financial stringency.

The company should also reserve the right to redeem debentures at their cash value, applicable at the time, in cases of involuntary termination of service and of death and permanent disability, but in the case of an employee leaving the service of his own accord within a certain period after the receipt of debentures, the redemption should be at par and interest.

The debentures should be convertible into stock of the company at the option of the holder, thus enabling him of his own volition at such time as he deems well to secure an interest in the company.

He must be absolutely free to determine, in his own uncontrolled discretion, whether and, if so, when to avail himself of this privilege, but it should be purely and cease if the holder dies or leaves the service of the company.

I favor issuing such debentures in registered form and making them non-negotiable, in order to avoid the possibility of the employee being exploited and, as has unfortunately proved the case among holders of Liberty Bonds, of being induced to part with them below their value or to exchange them for "wildcat" securities.

NECESSARY INFORMATION

A plan of this nature combines profit-sharing, an encouragement to saving and an eventual interest in the enterprise and avoids, in my opinion, many of the objections which have resulted in the failure of profit-sharing plans in the past.

It must, of course, be clearly understood by the employee that such a distribution represents a portion of the income of the enterprise after all charges have been met, that it is in no sense a bonus and that the distribution can only be made if there are surplus profits to be divided.

Prior to the making of such a distribution, an announcement with an appropriate financial statement should be issued.

In addition, general information in regard to the enterprise should be disseminated at fairly frequent intervals, so that the employees may know how the company is doing and may be encouraged to take an active interest in its affairs.

The employees should have every facility for making suggestions for improved methods, increased efficiency and elimination of waste, and I am confident that they would gladly welcome the opportunity to do this if they realize that such suggestions on their part, if practicable, will be reflected in additional profits, in which they will have their full share.

Two Chassis Models on the Humber 1920 Program

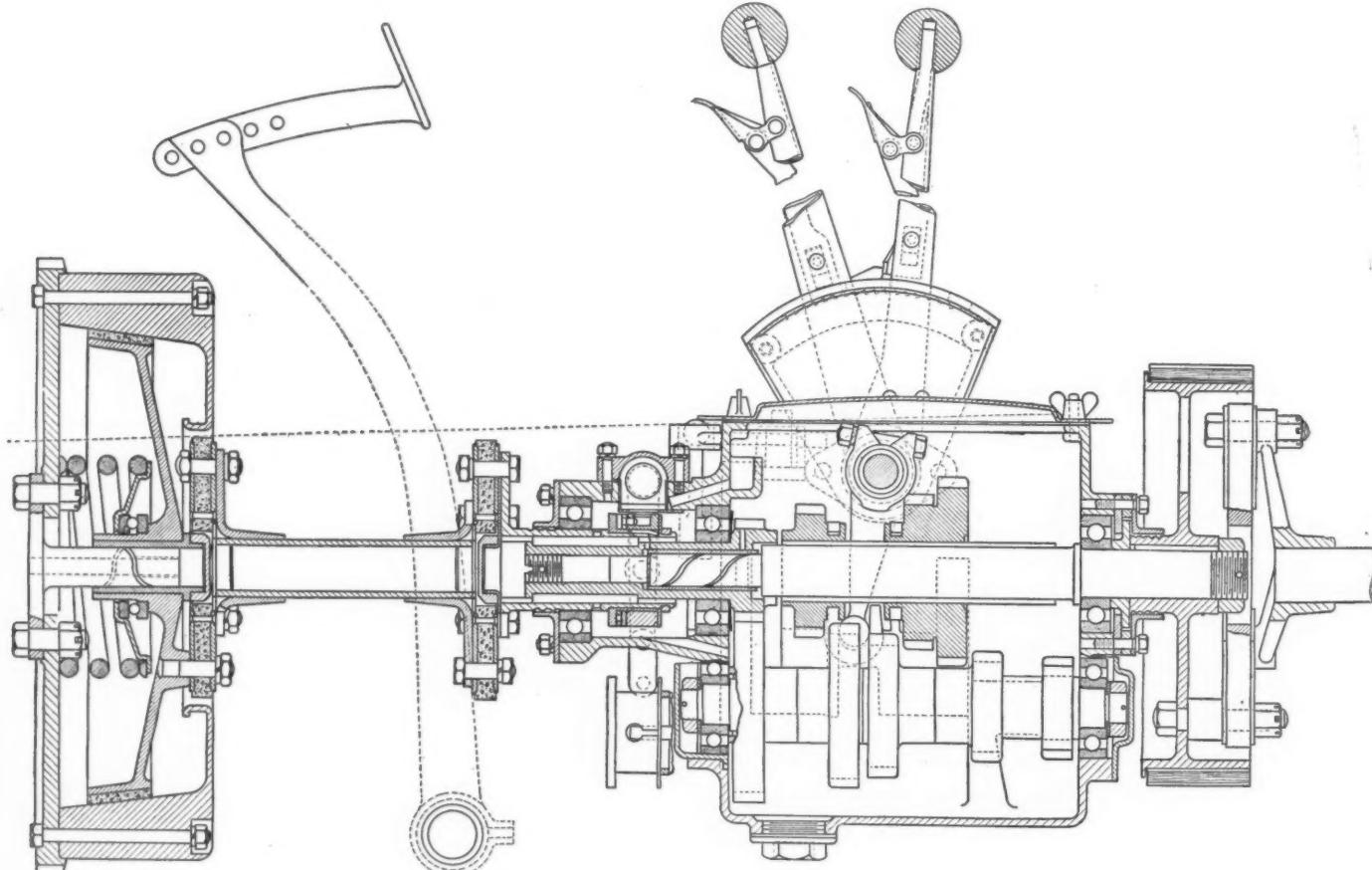
The 15.9 h.p. model differs in many respects from the pre-war model and is quite interesting to American engineers because of engine, clutch and gearset changes. The 10 h.p. model is practically the pre-war model, and is built for both two-seated or four-seated body use, with wheels, wheel-base and track changed.

By M. W. Bourdon

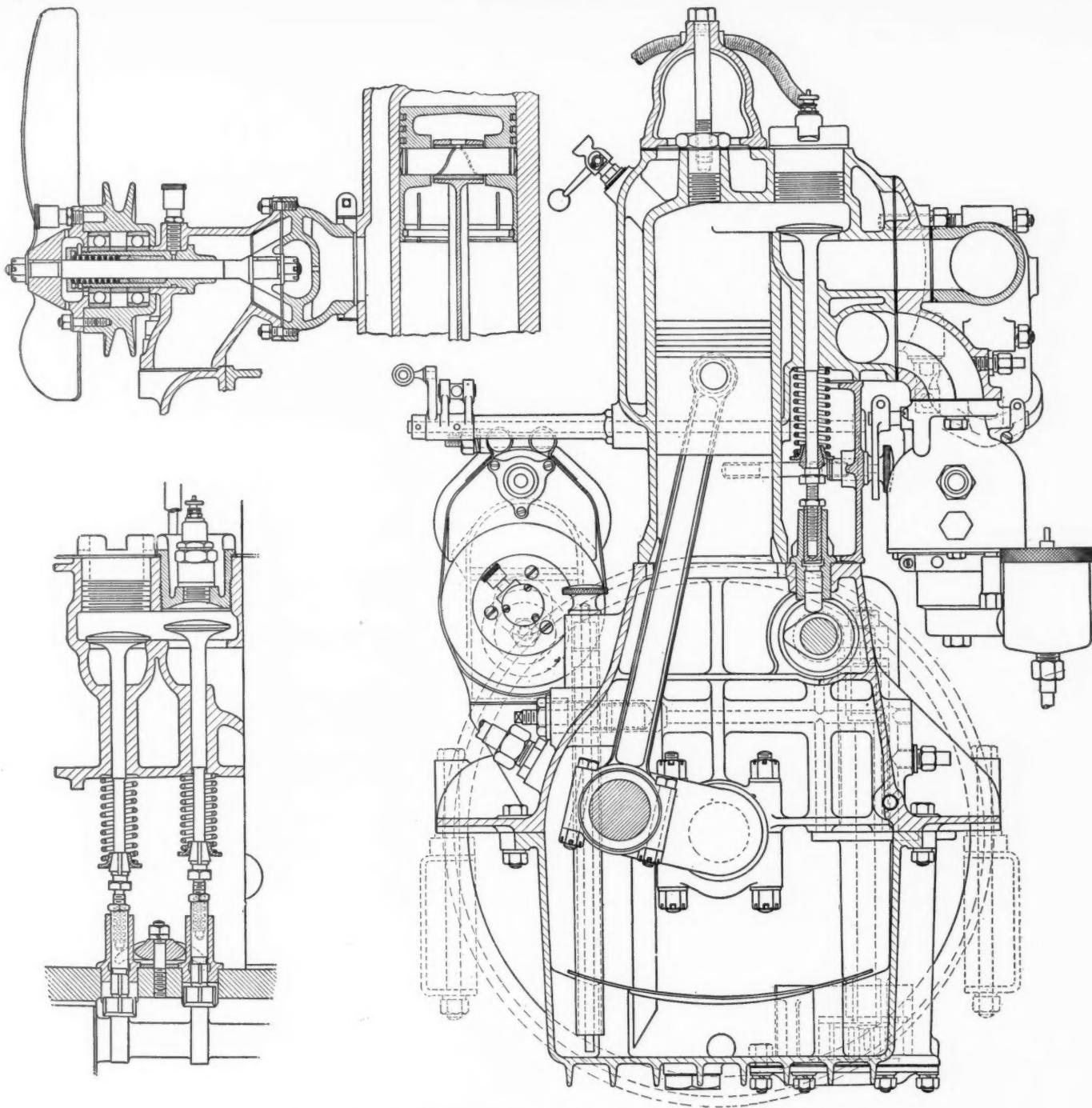
WO distinct chassis are on the Humber, Ltd., program for 1920. One model has variations rendering it suitable for either a two-seated or a four-seated body. This is the 10 h.p. type, with a four cylinder detachable head $2\frac{1}{8} \times 4\frac{1}{8}$ in. engine. This chassis in its two forms, one with a longer wheel base, wider track, and bigger wheels than the other, has gained great popularity; it was originally made in 1914, and except for the fitting of a full electrical equipment it differs little from the pre-war design.

The most interesting model, from an American point of

view, is the new 15.9 h.p. chassis. Although this bears some resemblance to the pre-war 14 h.p., it is quite different in detail, especially in regard to engine, clutch and gear-set. The four cylinder $3\frac{1}{8} \times 5\frac{1}{2}$ in. engine has its cylinders cast in a block and bolted to the crankcase upper half. Straight-sided aluminum pistons are used, but these have a special feature in that to overcome piston slap, the skirts are slotted axially and have an internal cast-iron ring tending, by its natural expansion, always to keep the skirt a good fit in the cylinder bore without risk of seizure.



Section through clutch and gearbox, showing also the transmission brake



Cross section of engine and detail, including valve gear, water circulator and fan mountings

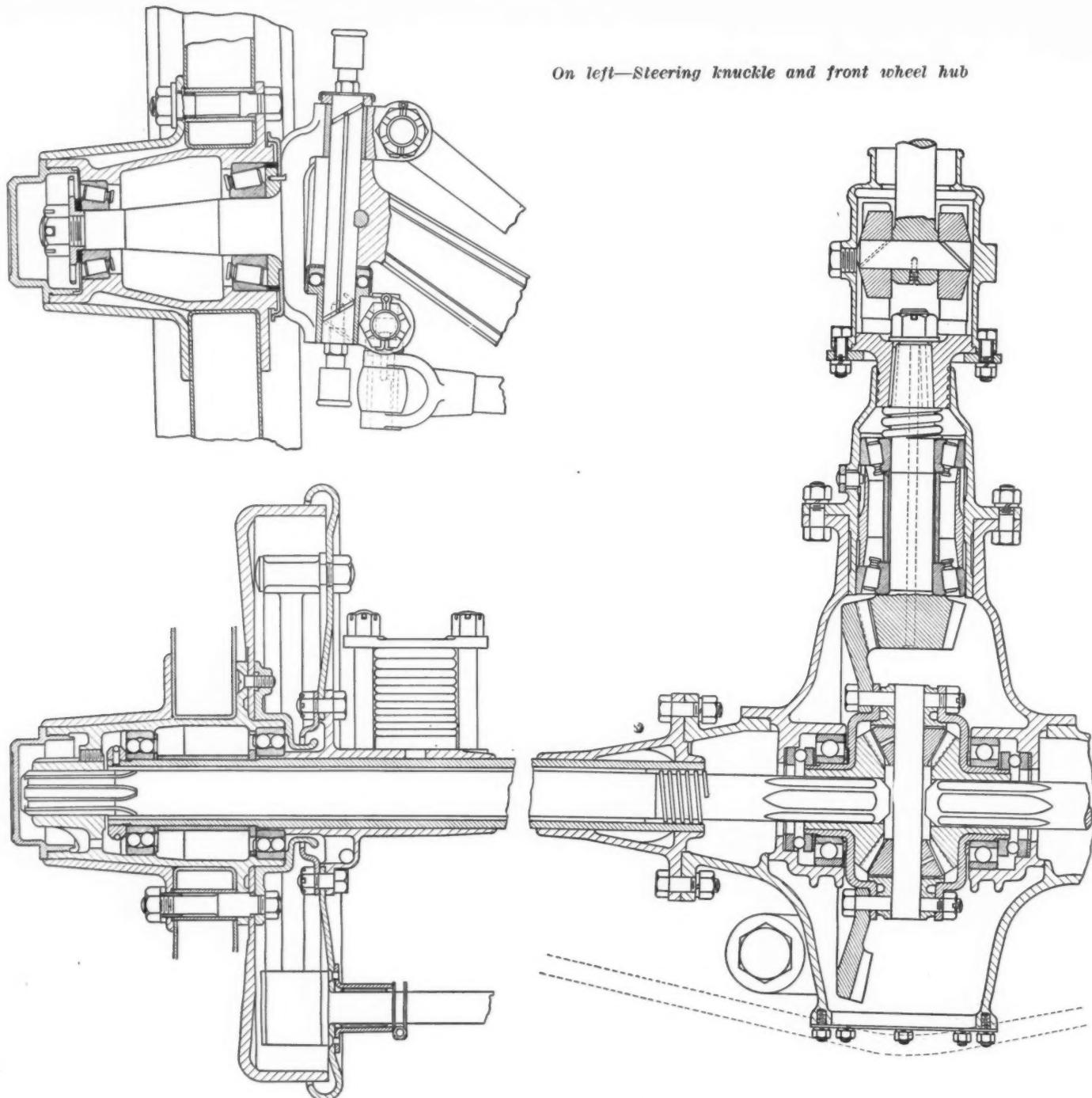
Force feed lubrication is provided for the main and crank-shaft bearings and also for the phosphor bronze bearings of the camhaft, splash serving for the pistons and cylinders, though baffle plates are fitted below the latter to prevent over-oiling. Two silent chains are used for the distribution, one for the camshaft and the other for the magneto. Plain-ended adjustable tappets operate the valves on the left, on the same side being the separate exhaust manifold and carbureter, the latter connecting to integral passages in the block by a short elbow. The carbureter has vacuum feed and is a Smith four-jet with a fifth jet and by-pass for starting and slow running. The mixing chamber is exhaust jacketed. Water circulation is on the assisted thermosiphon system.

An inverted leather-faced cone clutch is used, the short spring, applying pressure from within through a ball thrust race, being of 5 in. diameter and $\frac{1}{2}$ in. section. The clutch being enclosed and lubricated by castor oil, can be slipped constantly, a fact which allows a very smooth and gradual

take-up to be provided, but without slip occurring under normal conditions. The long clutch pilot bearing is lubricated by oil from the hollow crankshaft passing through a drill hole, charged with wick, in the center of the pilot extension.

The aluminum male cone of the clutch has bolted to bosses on its rear face the outer edge of a flexible disc joint, which is connected to a similar joint by a short coupling shaft. The latter is tubular with solid ends and conveys the thrust from the clutch-actuating mechanism housed within a front extension of the transmission casing. The rear-most flexible joint is connected by a second tubular shaft to a hollow extension of the primary constant mesh pinion, the two are telescoped and castellations convey the drive from one to the other.

The constant mesh pinion is supported by two widely spaced ball-bearings, one mounted directly against it and the other surrounding the outer drive shaft. The advantage of this arrangement is that, in addition to the wide support



On left—Steering knuckle and front wheel hub

Section through rear axle

for the constant mesh pinion, all the clutch actuating gear is enclosed and automatically lubricated from the oil in the transmission case.

A long phosphor bronze bush is used for the pilot bearing in the side-lever operated four-speed gear set, wherein all the other shaft supports are ball bearings.

Torque and thrust are taken by the rear semi-elliptic springs, the rear axle being of the full floating type with ball bearings throughout. The final drive is by straight toothed bevel gearing, giving a ratio of 4.33 to 1, the detachable wheels being of the hollow pressed steel type carrying 815x105 mm. tires.

A 12-volt two-unit electric equipment is fitted, the dynamo being belt driven and the motor operating through teeth on the flywheel.

It may be anticipated that this car, which has a wheel-base of 123 in. and a track of 57 in., will meet with a very big demand, for it represents extremely good value in these

days, with a five-passenger body, full equipment including clock, speedometer, luggage grid and the usual fittings, at £750. The finish of Humber cars, both as to chassis and standard bodywork, has for several years been out of the ordinary in the medium priced car class, while the makes now have an enviable reputation for sound, reliable products.

Unlike its larger brother, which has its engine and gear set mounted separately in a sub-frame, the 10 h.p. chassis has a unit construction, the engine, supported from three points in the main frame, carrying the gear casing bolted to its crankcase and clutch pit extension. This model, too, has a detachable cylinder head and the block formed with the upper half of the crankcase; it varies also from the 15.9 h.p. in that it has trough lubrication. Otherwise the two are on similar lines. The prices of this small model are £480 for the two-seater and £530 for the four-seater. In their class these two cars hold a pre-eminent position on the British market.

Airplane Wing Principle Applied to Watercraft

The wings of this new type of hydroplane lift the hull entirely out of the water and enable the boat to attain a speed of 70 miles per hour. The details of this latest achievement of Doctor Bell are explained in this article.

THE hydroplane is a form of craft which figured quite prominently in some of the motor boat races held in Europe previous to the war. The distinctive features of its construction are wings or fins which tend to lift it out of the water and thus reduce the resistance to its motion.

A rather different design, in which the lifting effect is obtained from lifting surfaces or hydrofoils which do not form an integral part of the boat body, has been developed by Dr. Alexander Graham Bell, and named by him a hydrodrome. The lifting members comprise several sets of hydrofoils which are of substantially the same form as the wings of aeroplanes, but very much smaller in dimensions. The lifting effect obtained from a plane of this sort is in direct proportion to the density of the medium through which it moves, and as salt water has a density approximately 800 times that of atmospheric air, the area of a hydrofoil need be only one eight-hundredth as great as that of an airfoil for the same lift at the same speed.

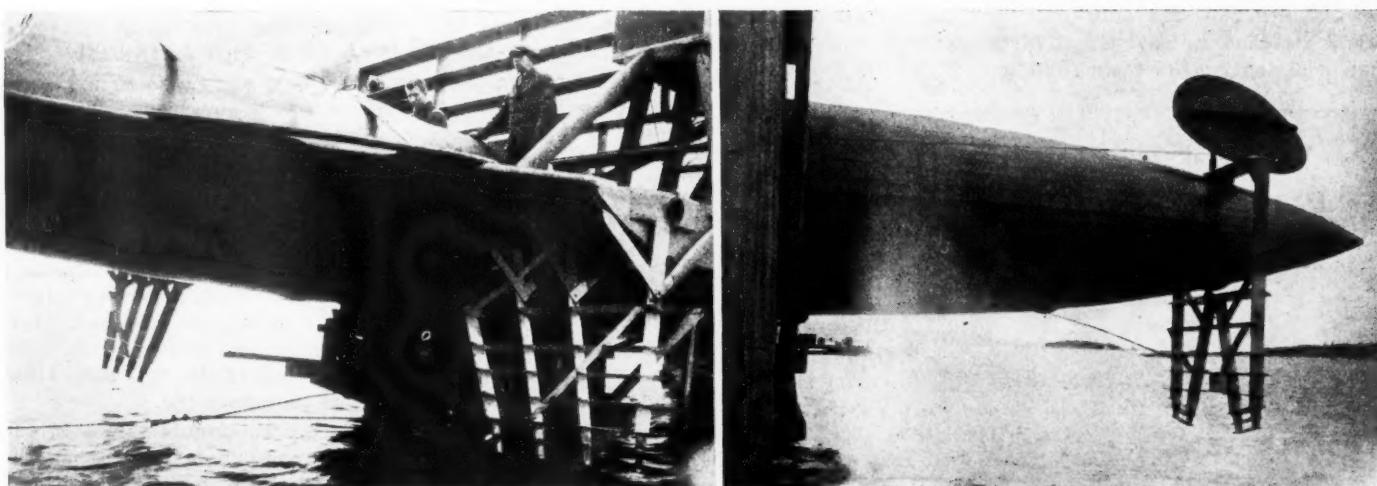
In a test recently made on Bras d'Or Lake, a speed of 60 knots, equivalent practically to 70 miles per hour, was obtained. When the machine is running at full speed the hull is entirely out of the water, and is supported by the small lifting planes. These are made of steel and decrease in size from top to bottom, with the result that as the speed increases and the craft rises further above the level of the water it is automatically "reefed," to use a familiar nautical term. The hydrofoil surfaces of the HD-4, (as the machine is called) support 1200 lb. per sq. ft. at 60 m.p.h., or about 120 times the load per sq. ft. carried on airplane wings in average practice.

The main structure of the HD-4 consists of a torpedo

shaped hull, 60 ft. in length, and 2 pontoons, each 16 ft. in length, which are connected to the main hull by a deck. This deck is made in the form of an aerofoil, having a plane undersurface and a cambered top, and presents a lifting surface of 203 sq. ft. Above the deck, and even with the cockpit are supported the two engines. Originally two 250 h.p. Renault engines were employed, but these have recently been replaced by two low compression or Navy type Liberty engines of 350 h.p. each.

When under way, the machine depends for support upon three sets of hydrofoils arranged to give a three point support, and thus to avoid a rocking effect. There is a fourth set of hydrofoils at the bow, called a preventer set, the object of which is to keep the machine from diving. The arrangement of the hydrofoils is not unlike that of the shutters of a Venetian blind, but the individual foils are set at a slight dihedral angle. If these foils were set parallel with the water, the whole of any one foil would leave the water at the same time, and there would be a certain jerkiness in the movement of the machine. The dihedral angle is fixed at such a value that the lowest point of one hydrofoil is on a level with the highest point of the next one below it, so that the "reefing" effect is continuous.

The rear set of hydrofoils is pivoted on a vertical axle and serves for steering purposes. Extensive experiments were carried out to determine the best angle of incidence for the hydrofoil, and the angle of 1½ deg. was finally decided upon for the forward set, while the stern set has its undersurface absolutely parallel to the water and only the suction effect on the upper face of the foil is depended upon for lift.



Partial views of Dr. Alexander Graham Bell's hydrodrome, showing the lifting surfaces

A One-Man Combination of Tractor and Tool

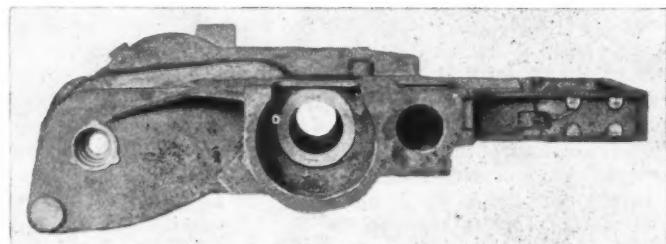
The Track Pull tractor described in this article has only recently made its appearance east of the Rockies. Its unique design gives it great versatility and stamps it as a real factor in supplying to the farmer machinery with which to supplant his horses.

AT the Wichita, Kansas, tractor trials last summer a farm tractor known as the Track Pull, which had seen several years' service on the Pacific Coast, made its debut in the territory east of the Rocky Mountains. The machine was originally built for orchard work and its sale was largely confined to the orchard districts of California, Oregon and Washington. Recently the engineers of the Bean Spray Pump Co. of San Jose, Cal., the manufacturers of the Track Pull, have developed a new model for field work. The power unit of this new tractor can be readily detached from one implement and secured to another, the operator sitting on the implement and steering and controlling the tractor from this position.

The Track Pull tractor is of a unique type and has a number of unusual features. There is a single drive track in front. The engine, radiator, transmission, etc., are all mounted on a single main frame casting and the track is driven under this mechanism. This one track does all the pulling, and this pulling unit can be steered as desired. It is steered as effectively and almost as easily as horses are guided in the direction in which they are to go.

The pulling unit is 30 in. wide, 43 in. high and 72 in. long. It is designed to be attached directly to and be driven from all farm implements, such as binders, mowers, drills, cultivators, etc. This machine is a good example of the tendency in tractor design toward greater versatility. An attempt has been made to supply machinery to the farmer which will effectively take the horses from his farm. This power unit will not only pull two 14 in. plows, but is easily attached to any useful farm machine, making a one man combination of tractor and tool.

A twin cylinder V type engine of the company's own make is used. It has its cylinders cast in a block and develops under continuous load 10 h.p. on the belt. The cylinder dimensions are $4\frac{1}{2} \times 4$ in., the latter being a stroke. Either kerosene or distillate may be used for fuel. A flyball type of governor is fitted, but the speed is also under the con-



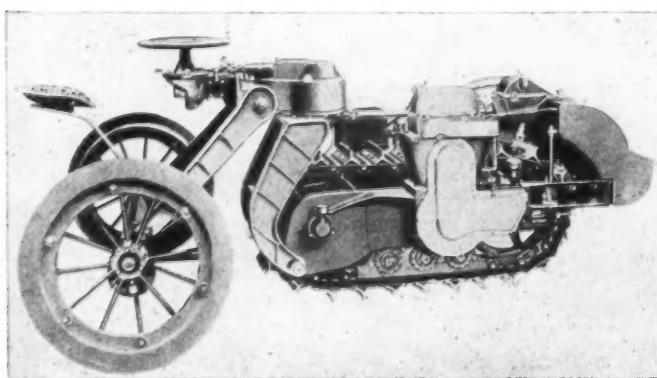
Main frame casting

trol of the driver. Anti-friction bearings are used throughout the engine, the main and camshaft bearings being of the ball type, and the connecting rod bearing a special type of roller bearing made by the company itself. The engine is of valve-in-head construction, the valves being fully enclosed and efficiently oiled.

Ignition is by a high tension magneto with impulse starter. Cooling is by centrifugal pump, radiator and fan. A Madison-Kipp force feed lubricator is used, feeding oil directly to all of the bearings. The lubricating system is not circulating, that is, if no oil is used over.

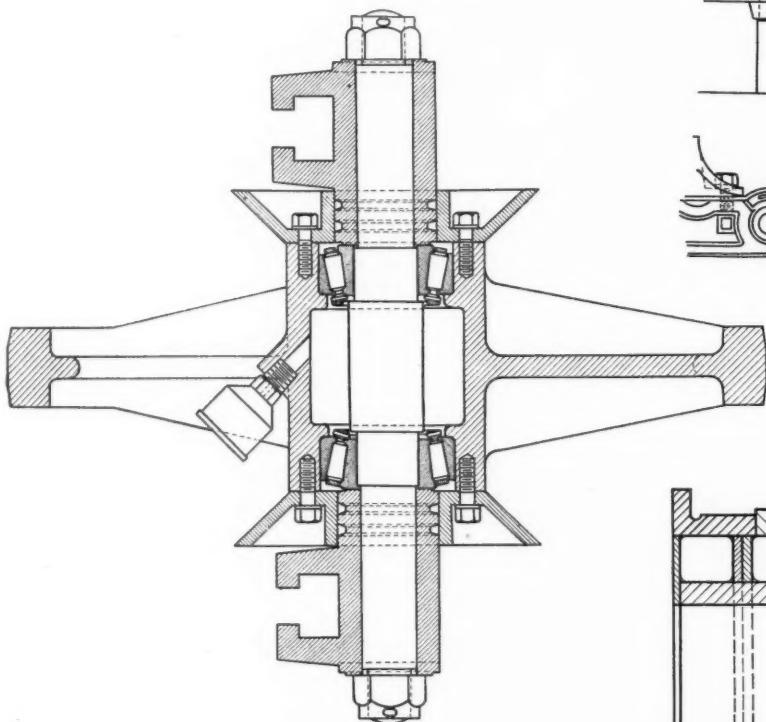
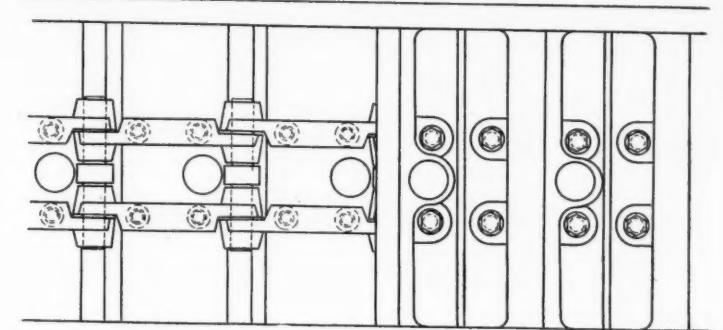
The cylinders are cast in a block, the included angle being 42 deg. The cylinder head is a one piece casting secured to the cylinder casting with twelve equally spaced studs. The camshaft is placed within the angle included between the cylinders. An aluminum cover protects the operating mechanism of the overhead valves from dust. The motor is allowed to breathe into this cover and from this into the transmission case. There is no regular crankshaft, but instead the crank pin is secured to two large balance wheels, which are mounted on ball bearings, while the forked or straddle-type connecting rods are mounted on specially designed roller bearings of unusual size which work on the hardened sleeve of the crank pin.

One rather novel detail of construction is found in the connecting rods. When these are unclamped from the heavy outer races of the bearings, the pistons and rods may be removed through the cylinders. It will be noticed that

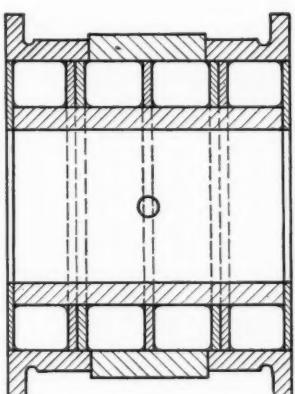


Track Pull tractor complete

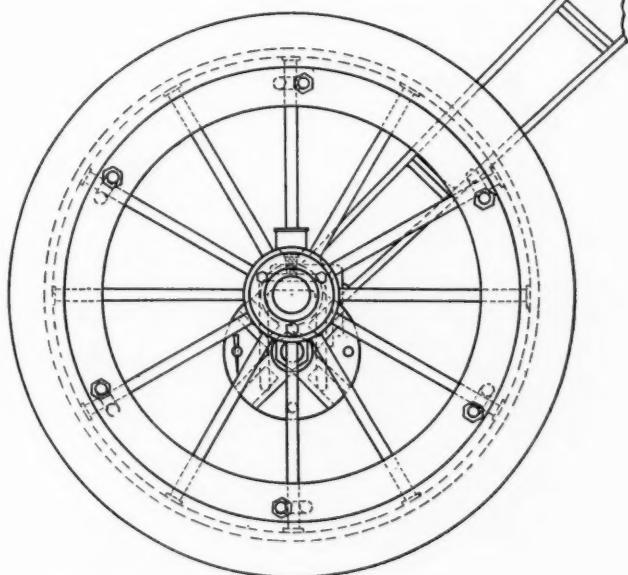
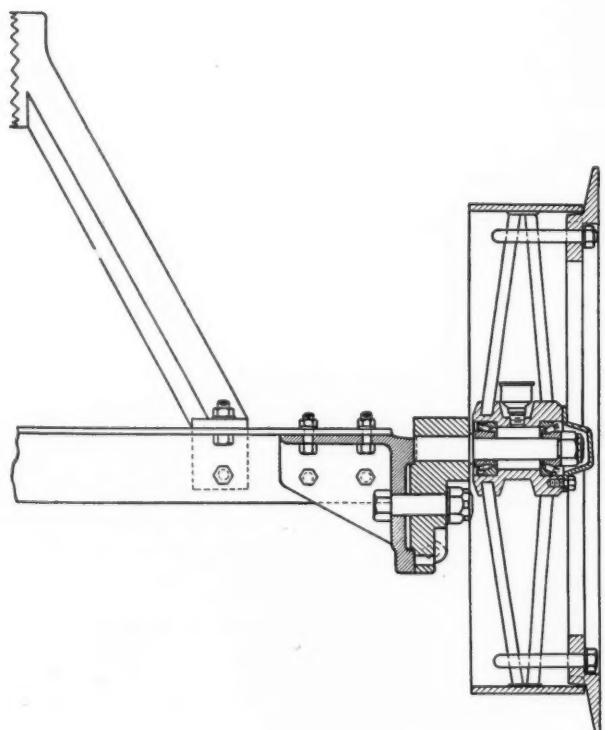
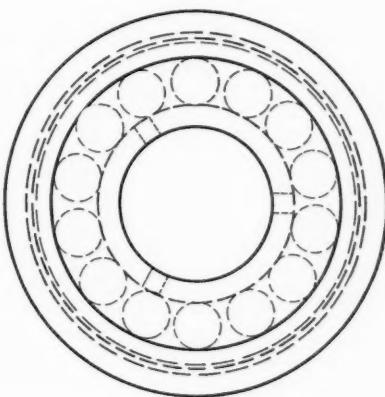
On right—Three views of the chain track—the upper drawing showing both a top and bottom view



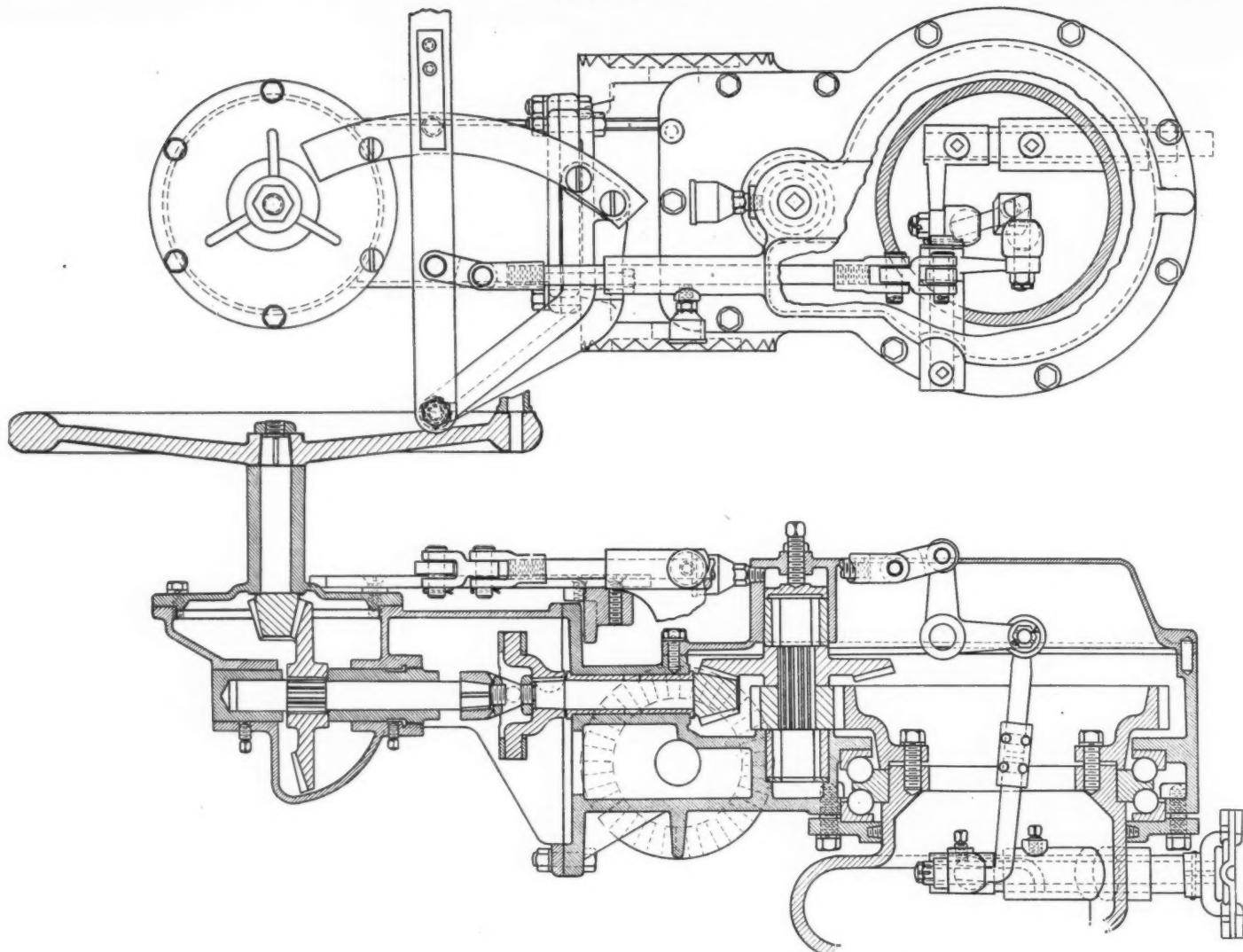
On left—Idler wheel on which track runs



On right—Roller bearing used on crank pin



Trailer wheel with guide flange to give positive steering



Steering gear of the Track Pull tractor

as these rods simply clamp on the bearing races, the connecting rod bearings are not disturbed when rings, piston pins, or bushings are to be examined or renewed.

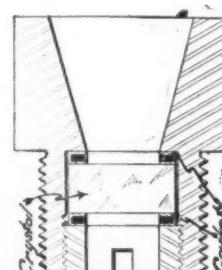
A feature of interest is the marine type reversing mechanism. The cone type clutch runs in oil and the clutch and reverse mechanism is operated by a lever from the seat. When the clutch is disengaged a further movement of the lever tightens a band upon the clutch drum, thus holding it against rotation and causing the reversing gears to operate. The reverse speed of the tractor is one-half its forward speed.

Under the old rating formula the engine would develop a draw bar h. p. of 8, but under the new formula the rating is 5 h.p. The sparing is such that a speed of 3 m.h.p. is developed on forward motion, while the reverse speed is half the forward speed.

A belt pulley 16 in. in diameter is fitted, and gives a belt speed of from 800 to 2,000 ft. p. m. Cut, hardened and heat treated steel gears on splined shafts are used throughout the transmission. The final drive is through hardened steel sprockets, driven from a splined shaft. A marine type reverse gear and cone clutch of the company's own make is fitted. Timken roller bearings are used throughout the tractor, and are enclosed in dust proof cages.

The single track is made of hardened steel links, and is not lubricated. The tractor and rear wheels together are 110 in. long, 66 in. wide, and 47 in. high. Pulling a full load, the Track Pull tractor can turn in a 5 ft. circle. The weight of the tractor complete is 3,000 lb.

The manufacturers claim that owners of their machines have never had any track upkeep expense; that machines now in their fourth year of work show a very small amount of wear on the track elements. The links and pins are made of high carbon steel and hardened. Each pin has a 4 in. bearing in the links and is held in place by a shoulder at its center. This construction eliminates the use of nuts, pins and cotters to keep the pins in place and they are free to revolve.



The Hopewell Site Hole

A DEVICE designed to permit of judging the operation of an engine by the color of the flame of explosion is being marketed by Hopewell Bros. It consists of a threaded iron shell, of the size of a spark plug shell. Inserted within this shell is a fusible quartz crystal held in place by copper asbestos gaskets and a threaded bushing. This latter allows the crystal to be removed if necessary. The crystal is of fused silicate or amorphous quartz, and is said to be capable of withstanding the highest of temperatures. It has a low coefficient of expansion. This crystal is polished on both sides.

A Single Unit Starting and Lighting System Developed in France

The Dynastart, a combination generator and starter, is the post-war development of a large French manufacturing concern. The essential features of this new system, which forms a part of the equipment of many new French cars, are summarized here.

IN descriptions of French cars, reference is constantly made to the S. E. V. electric system, which is fitted to many of the new models. The Societe Anonyme d'Equipment Electrique des Vehicules, of Issy les Moulineaux, was organized at the beginning of the war to take over the business which had been developed in France by Robert Bosch. It is devoted chiefly to the manufacture of magnetos, but in addition has been marketing a small generator. After the conclusion of the war, the combined generator and starter, known as the Dynastart, was added to the line, and it is this single unit machine which forms the equipment of many new French cars. The following description of this machine is based on an article in "La Vie Automobile":

The Dynastart is a four pole generator. It has both a shunt and a series of field winding, the latter being used for starting only. The armature is of the drum type, with a parallel winding. Owing to connections within the armature itself, only two brushes are required.

Across the generator brushes a c is connected to the shunt field winding and included in this circuit are a cut out of known make and a voltage regulator of the vibrator type. The negative brush is connected to ground, the single wire

or ground return system being employed. The two brushes a and c are of carbon, and the relatively high electrical resistance of this material tends to improve commutation. From these same brushes mains lead to the storage battery through the intermediary of the cutout, and the voltage regulator, and connected to the charging mains is the load line.

On the periphery of the commutator, opposite the generator brushes, are located the two starter brushes b and d. As a very high current has to pass through these brushes, it is essential that their electrical resistance should be low, hence they are made almost entirely of red copper, and therefore

(Continued on Page 1260)

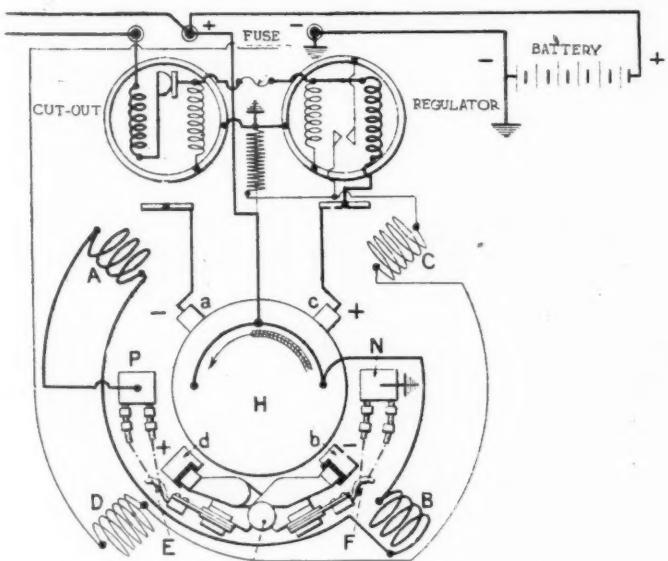


Fig. 2—Circuit diagram of Dynastart

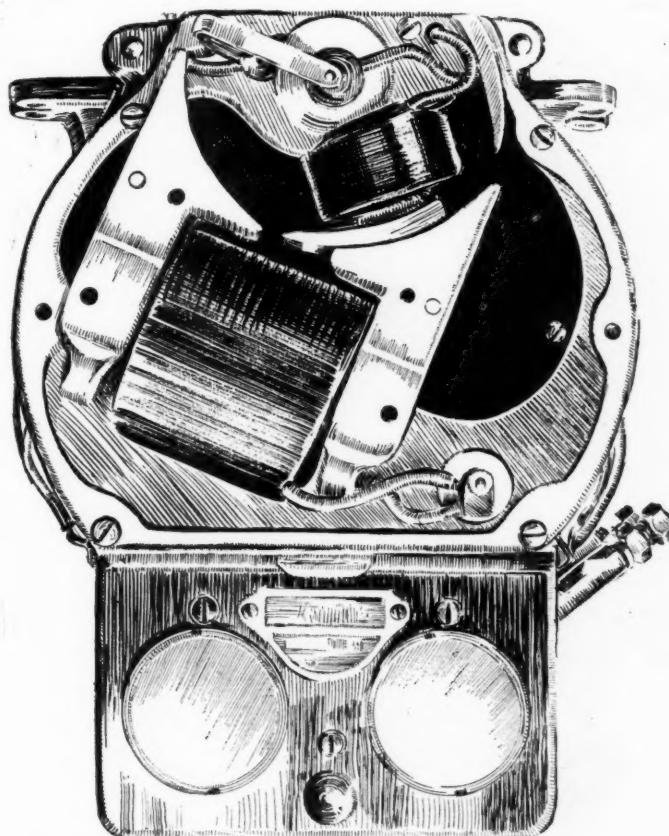


Fig. 2—Electric control gear on Dynastart

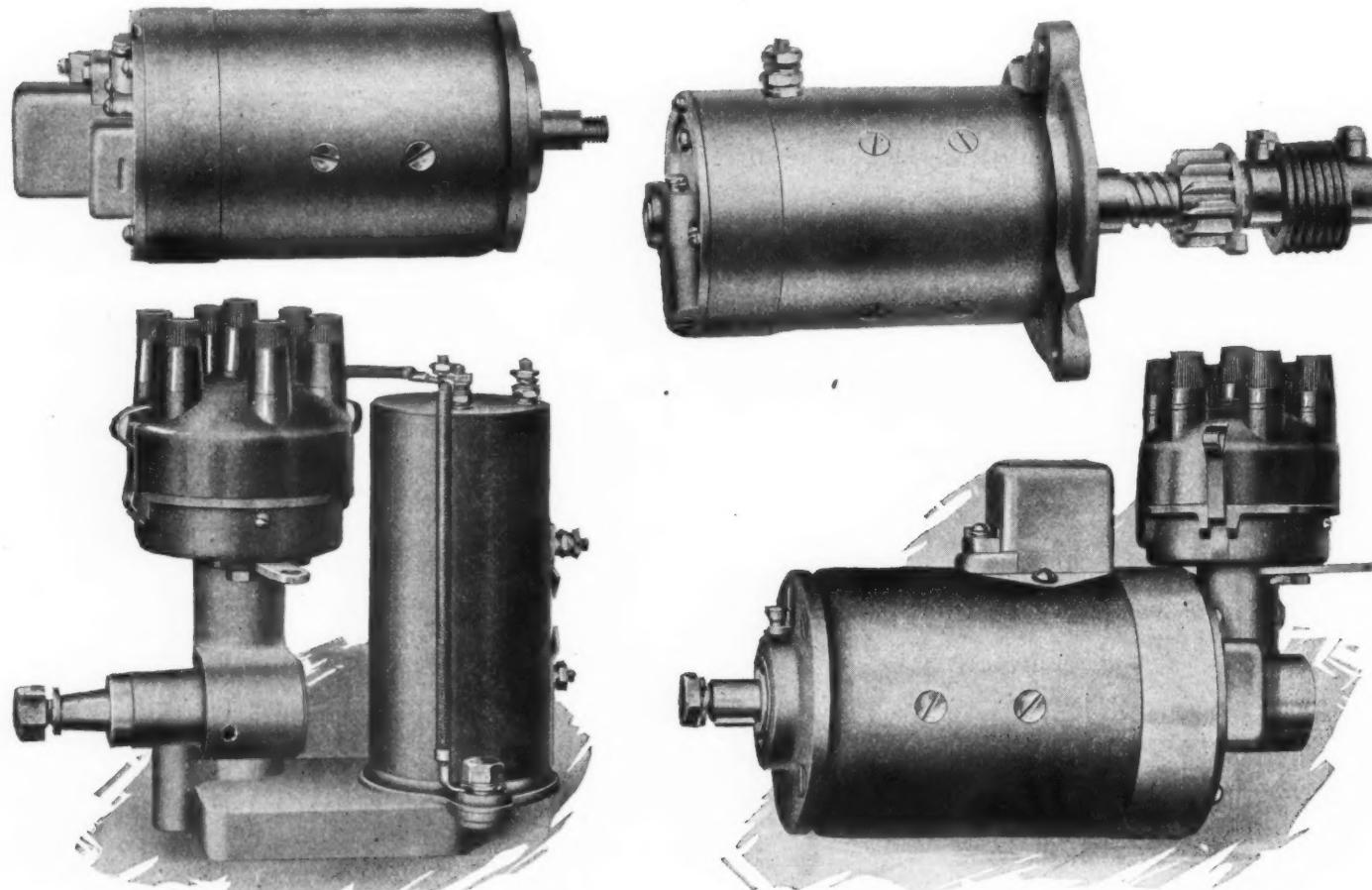
A Flexible Closed Circuit Type of Ignition

In an electric system such as described here it is an easy matter to change a four cylinder ignition set to one adapted to the six cylinder machine, or vice versa, by simply shifting the cam and distribution head. The flexibility of such a system is what makes the appeal to the manufacturer who is interested in machines that meet a wide range of demand.

THE completion of a novel system of electric distribution is announced by a firm that has experimented extensively in the field of automobile lighting and electric equipment. The ignition system is of the closed circuit type, in which the interrupter and distributor are combined as usual. Two methods of mounting are offered. In one, the interrupter, distributor and coil are placed together on a base plate which can be installed on a standard magneto bracket and driven from the magneto drive shaft, the height of the driving shaft and its end being in accordance with the S. A. E. standard. In the other arrangement, the interrupter and distributor are mounted on the end of the generator. The sponsors for the new system are Gray & Davis, Inc. Both

of the arrangements referred to are illustrated by photographs.

The interrupter arm consists of a steel pressing, carrying a fibre block which engages with the cam formed on the interrupter shaft. Tungsten contact points are employed, the stationary contact being mounted on a pressed steel bracket which is insulated from the interrupter base by fibre. One of the interesting features of design is that in varying the timing of the spark the interrupter housing itself does not move, but instead a plate inside the timer housing rocks around its axis, this plate carrying the lever arm and turning around a pilot on the hub of the housing. There are two angular slots in the back of the housing and two screws connect the timing lever



Above on left—Generator with cut-out switch on end plate. Above on right—Starting motor with Bendix drive. Below on left—Magneto replacement ignition system. Below on right—Generator with ignition unit.

to the plate. A contact brush insulated from the housing makes contact with the bracket carrying the interrupter lever, and there are therefore no moving wires. On the opposite side there is a similar spring which serves the purpose of holding the plate down.

Bakelite is the material used for the distributor block. The distributor head is held in place by means of two spring clips, and is located by a dowel so that it cannot be put on wrong. With the new Gray & Davis construction, it is an easy matter to change a 4-cylinder ignition set to a 6-cylinder and vice versa, all that is necessary being to change the cam and the distributor head. The interrupter cams are ground and lapped, the grinding being done to profile. The multiple point interrupter cam is of the flattened cylinder type. A pressed steel washer with two locking pins is located on the top of the cam. Then follows a nut, and then comes the distributor arm of Bakelite which is pressed on. The pressed steel piece has an upturned flap which enters a slot in the bakelite arm and drives same.

THE DISTRIBUTER POINTS

For the central contact there is a flat spring on the distributor arm which presses against a carbon brush set centrally in the distributor head. The distributor points are made of spark plug nickel wire, and are spun or staked into steel pieces which in turn are moulded into the distributor head.

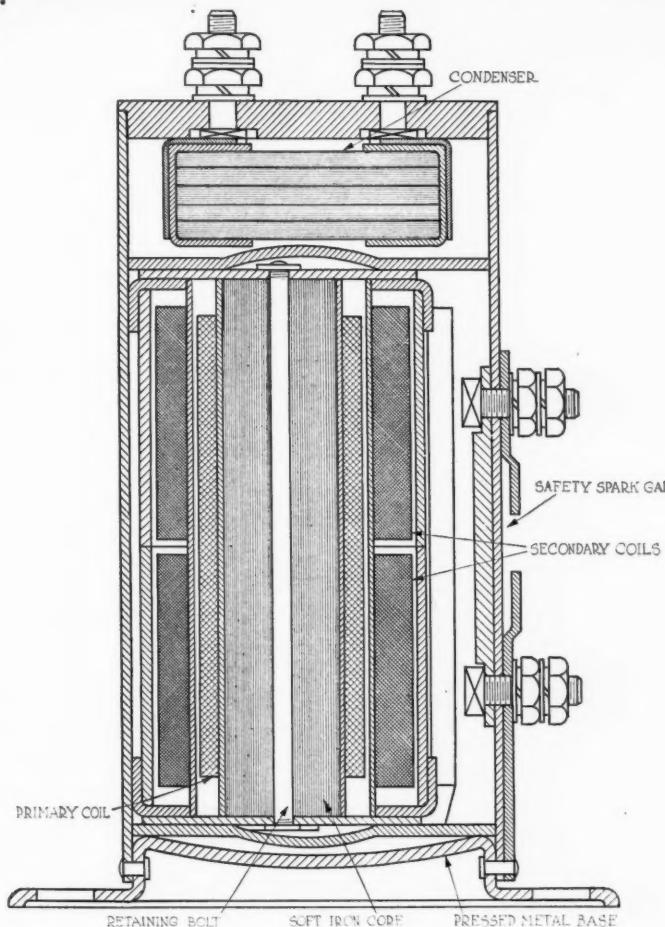
Hexagon cap nuts are covered with an insulating material by the moulding process. Stranded wires pass through a small hole in the cap and are clamped between the cap of the nut and the rounded head of the screw. Soft rubber washers under the nut serve as a lock and make the construction watertight.

A sectional view of the ignition coil is shown herewith. The coil is enclosed in a fibre tube with a pressed steel base and a cover of insulating material. The condenser is included with the coil, being located in the upper part of the housing. The secondary winding of the coil is made in two parts, which are set end to end. A safety gap is formed on the side of the coil. The condenser is made of oil paper and tinfoil, held in pressed steel clamps and secured to the coil cover. Two terminals are soldered to these clamps.

Two secondary terminals come out at the side of the coil. From one of these connection is made to the distributor, and from the other to the ground. There are three terminals on top of the coil, one for connection to the interrupter, one to ground and one to the switch.

A die cast aluminum base is used, the pressed steel base on the coil being secured to the aluminum base by two grounding screws. The ignition system is operated on 6 volt current.

A die casting is used for the base and driving gear housing of the distributor. The driving shaft runs in a bronze bushing which is cast in with the die casting, being knurled on the outside so as to be held firmly. The driving gears are helical, the driving member of steel, and the driven of bronze. These are packed in grease, and a pressed steel cover is forced into the end. While the gears themselves are dependent upon the grease for lubrication, wick oiling is used for the bearing of the driving shaft. Oil is introduced through an opening at the side, which is fitted with a snap cover. This oil collects in a well,



Section through ignition coil

from which it is elevated by the wick. A cone set screw on the side of the base column locates the hub of the interrupted housing. The total weight of the magneto interchangeable set is 6 lb. 3 oz.

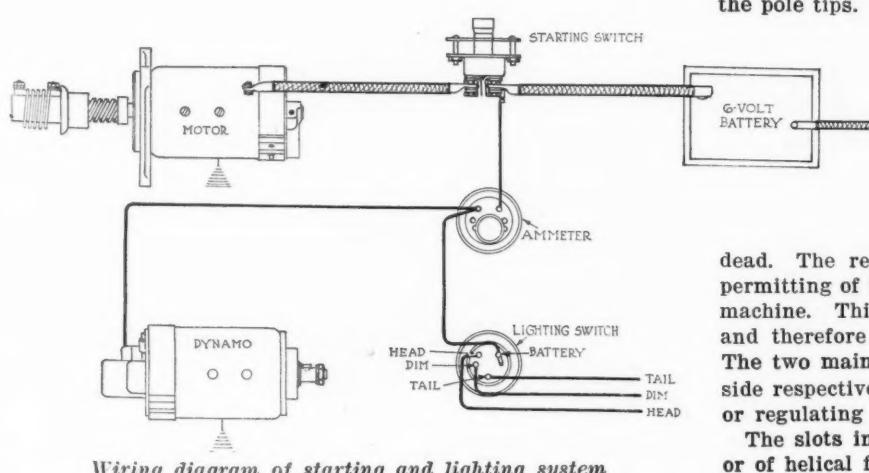
TWO SIZES MADE

Two sizes of generators are made, both four pole machines. The smaller one is 4 in. in diameter, and develops a maximum output of 90 watts at 1400 r.p.m., while the larger one is 5 in. in diameter and develops 108 watts at 1200 r.p.m. The field frames are drawn in the press, and when completed are about $\frac{1}{4}$ in. thick, with an in-turned flange at one end and four lateral projections at the other to support the end cap at the other end. The field poles are made of rolled stock which is cut off to length. No machining is required by the pole pieces, aside from the cutting off operation, and each pole piece is held to the field ring by two flat headed screws. The field coils are form-wound and taped, and are held in place on the poles by the pole tips. The field winding is a plain shunt winding. The

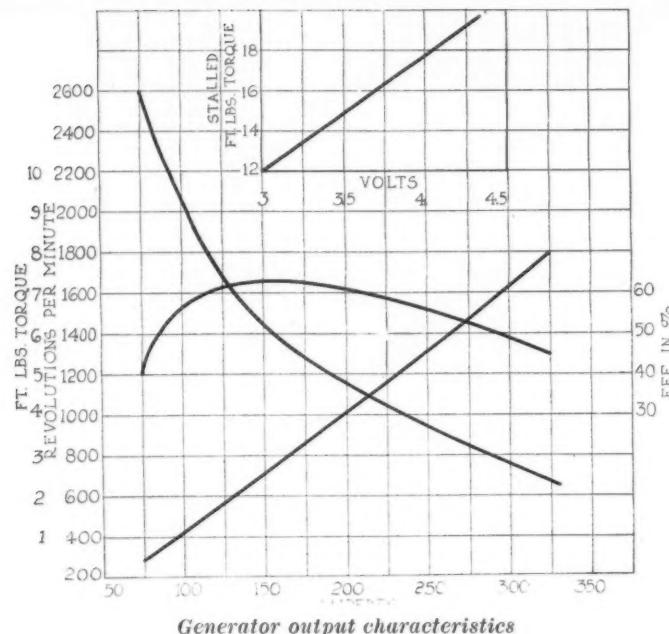
bare leads of the field coils are insulated from the field ring by a layer of Peerless paper insulation. One end of the field winding is grounded to the frame, the single wire or ground return system being used throughout.

The armature is hand wound. There are 17 slots in the core, and two sections are wound in each slot, one section being left dead. The reason for this is that a series winding is used, permitting of the use of two commutator brushes on a four pole machine. This winding calls for an uneven number of sections, and therefore makes it necessary to leave one section dead. The two main collector brushes are located on top and on the side respectively, where they are most accessible, and the third or regulating brush is opposite the two main brushes.

The slots in the armature core of the generator are twisted, or of helical formation, the object being to insure silent opera-



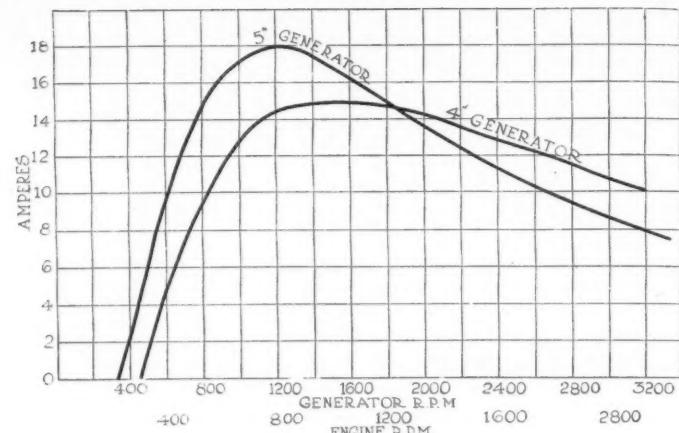
Wiring diagram of starting and lighting system



Generator output characteristics

tion. The commutator is of conventional design with mica insulation. An interesting feature of the generator is the rack and pinion adjustment for the third brush, which can be operated from outside the generator housing by means of a screw driver. The arrangement is clearly shown in one of the illustrations herewith. Friction holds the adjusting ring in position. The brush holders used are of the rocking type.

Output control is entirely by the third brush system, and the output varies with the speed as shown by the curve. By adjusting the position of the regulating brush, the power curve can be varied. To prevent injury to the machine in case it should be operated at high speed with the battery disconnected a fuse is inserted in the field circuit. As with other systems, a cutout is employed, and this can be placed either on top of the generator or on one end. It is generally placed on top when the tandem drive is used, that is, when some other accessory like the pump is driven through the generator. The cutout is of



Starter characteristics

standard construction, being based on the electromagnetic principle with both series and shunt windings. Cast iron end plates are used for the S.A.E. standard mounting. The generator can also be mounted on a cradle.

Very much the same design is used for the starting motor and for the generator, the same field structure being employed. The starting motors, of course, are series wound, the four field coils being connected two in parallel and two in series. Bare copper bars are used for the armature winding, a single bar per section, these being inserted into the core slots from the end, and insulated with Peerless paper insulation. The slots of the starter are made parallel with the core axis as silent operation is not so essential. On the commutator of the starting motor there are four brushes, and these are of heavier type than those of the generator.

As in the case of the generators, two sizes are made, of 4 and 5 in. diameter respectively. With the 5 in. starter, either 11 or 13 tooth pinions are used, while with the 4 in. starter an 11 tooth pinion is employed, the teeth being of 8-10 pitch. On the starting motor the same oiling system is used as on the ignition device, that is, the plain bearings are oiled by means of wick oilers. There is an oilless bushing in the outboard bearing of the Bendix drive. Both the electrical and mechanical characteristics of the starting motors are in the accompanying curves.

A French Lighting System

(Continued from Page 1257)

are very soft. These brushes are normally raised clear off the commutator as shown in Fig. 1. The brushes b and d are carried by swiveled holders, which by means of a cam G may be applied to the commutator. If this cam is operated, the brushes begin to descend upon the commutator. But they are electrically insulated, and therefore no current passes. When the contact is made, the cam G continues to rotate, and the fingers EF, which are electrically connected with the terminals of the battery, begin to press on the brushes and establish electrical connection. The object of this arrangement is to prevent destructive arcing when the circuit is interrupted. If the break occurred between the brushes and the commutator, the latter would be rapidly destroyed. With the movable fingers E F, this spark occurs between these fingers and the brushes, and when the brushes leave the commutator, the current has already been interrupted.

Fig. 1 is a diagram of connections of the Dynastart. Suppose the brushes b d to be lowered on the commutator. Current from the battery positive terminal then flows successively through series field coil A, series coil B, terminal P, through a flexible cable to finger E, which presses on brush

d. From there the current flows through the armature, which it leaves through brush c, to the terminal N, thence through ground back to the negative terminal of the battery. At the same time that the armature current flows through the series field coils, a small current flows through the shunt coils of the field poles, which slightly increases the starting torque.

The Dynastart is operated by means of a handle keyed to the cam G. A suitable linkage or a Bowden wire mechanism connects this handle to an operating device placed close to the driver's seat. Sometimes, however, the installation of a linkage or of a flexible control is not easy, on account of the numerous turns required, and for this reason the S. E. V. has provided an electrical control of the cam as illustrated in Fig. 2.

IT IS stated in the press that this year there have been sold in this country foreign government loans aggregating \$469,000,000. This greatly exceeds the prewar loans of any like period.

Double Friction Back Gears Increase Turret Lathe Power

The power and speed range of the new No. 6 Warner and Swasey Turret Lathe are much greater than on ordinary lathes. This article tells how the increase has been accomplished

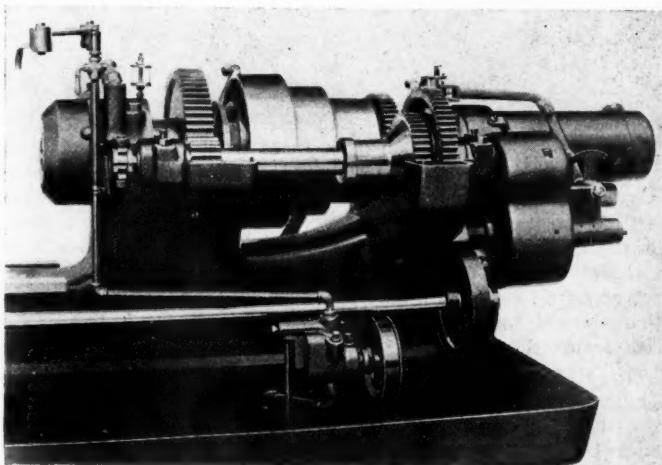
DOUBLE friction back gears are an outstanding feature in the new No. 6 W. & S. turret lathe. These double back gears greatly increase the power and speed range of the tool. As the machine has a three step coned pulley, nine different spindle speeds are available. With double back gears heavy forming and facing cuts can be taken on both bar and chuck jobs.

This new turret lathe is furnished with either a standard or a heavy duty carriage, with or without automatic bar feed, power cross feed to the carriage slide and power feed to the turret. With the heavy duty carriage the lathe will handle gear blanks and other tough alloy steel parts to advantage.

The heavy duty carriage has power cross and hand longitudinal feeds. The cross feed can also be operated by hand. Six power cross feeds and reverse are obtainable in the apron; the three finer feeds are particularly suited for forming and the three coarser for facing. The cross slide is fitted with a dial graduated to 0.002 in. Adjustable stops are provided for either direction. The front tool post is round, has an adjustable wedge and is arranged to be swiveled at any angle. A cutting-off tool holder is regularly furnished for the rear. Either of these tool holders may be removed, and forming tool holders substituted.

Hand longitudinal and cross feeds are regular features of the standard carriage type. Adjustable stops are provided for the cross slide. Automatic chuck and bar feed are operated by the long lever in front of the head. A stepped wedge automatically adjusts the collet for slightly varying diameters.

A master collet and bushing pads are furnished with this machine for holding 2 1/4 in. round stock. Bushings for hexagon stock can be held in this collet also. Square stock requires a square stock master collet and bushing pads. Extra capacity

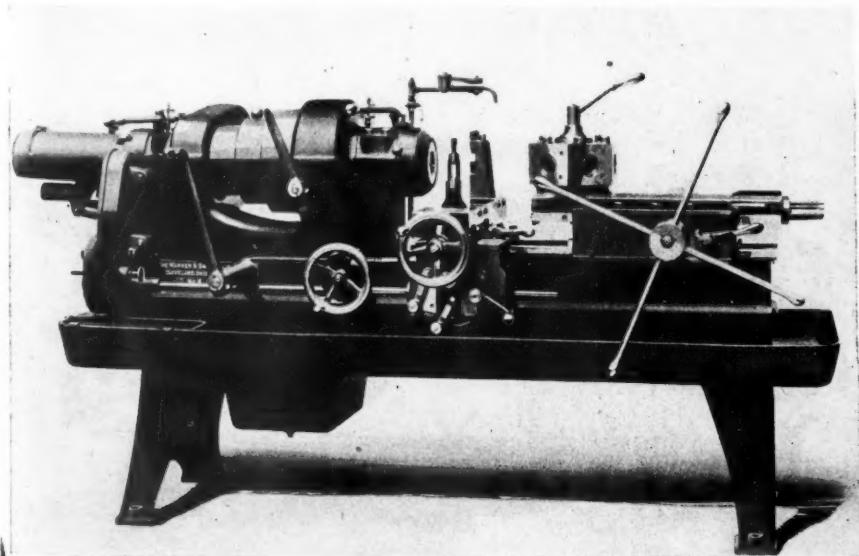


Rear of head with guards removed to show double friction back gears

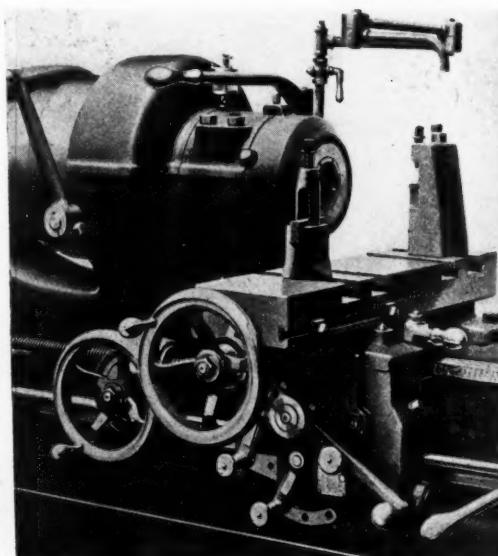
collets can be used for holding short length work larger in diameter than the capacity through the spindle.

The turret is revolved automatically by the backward movement of the slide. The locking bolt is at the front end of the slide and works into steel taper bushings inserted in the bottom of the turret close to its outside edge directly under the cutting tool.

Independent adjustable stops operate automatically for each position of the turret, and disengage the power feeds. They are readily adjustable for the length of each cut.



Warner & Swasey No. 6 turret lathe with heavy duty carriage



Heavy duty carriage

A Tractor Engine for Heavy Duty

The new Midwest tractor engine comprises several unique features, among which are a connecting rod of unusual form, the elimination of the breather on the crankcase, and a connecting rod bearing which is cast in the rod. This engine is designed especially for heavy duty and weighs more than most engines of like dimensions.

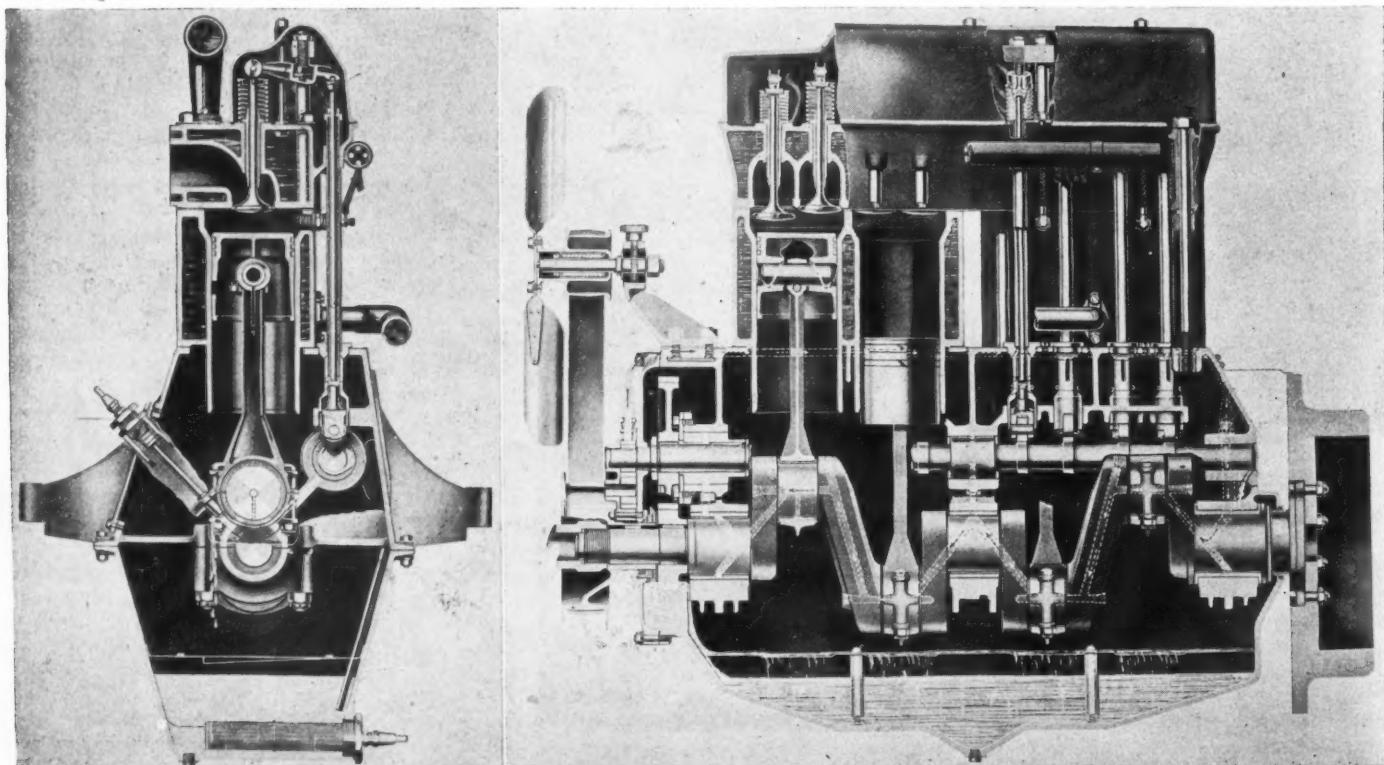
PREVIOUS to the war the Midwest Engine Co., the successor of the Lyons-Atlas Co., built farm tractors, but during the war this line was discontinued, as the company went very heavily into Government work. Since the signing of the armistice, the concern has developed a number of new lines, including a small tractor known as the Utilitor recently described in these columns, and a tractor engine which will be made in four sizes, all four cylinder models, with the following cylinder dimensions: $4\frac{1}{2} \times 6$, 4×6 , 4×5 and $3\frac{1}{2} \times 5$ in. The first of these sizes forms the subject of this article.

The Midwest tractor engine has been designed strictly as a heavy duty type, and is undoubtedly heavier than most other tractor engines of the same cylinder dimensions. The general design is plainly shown in the two sectional views herewith. The engine is of the overhead valve type, with the cylinders cast in pairs, a separate cylinder head casting extending across both pairs of cylinders. The crankcase is

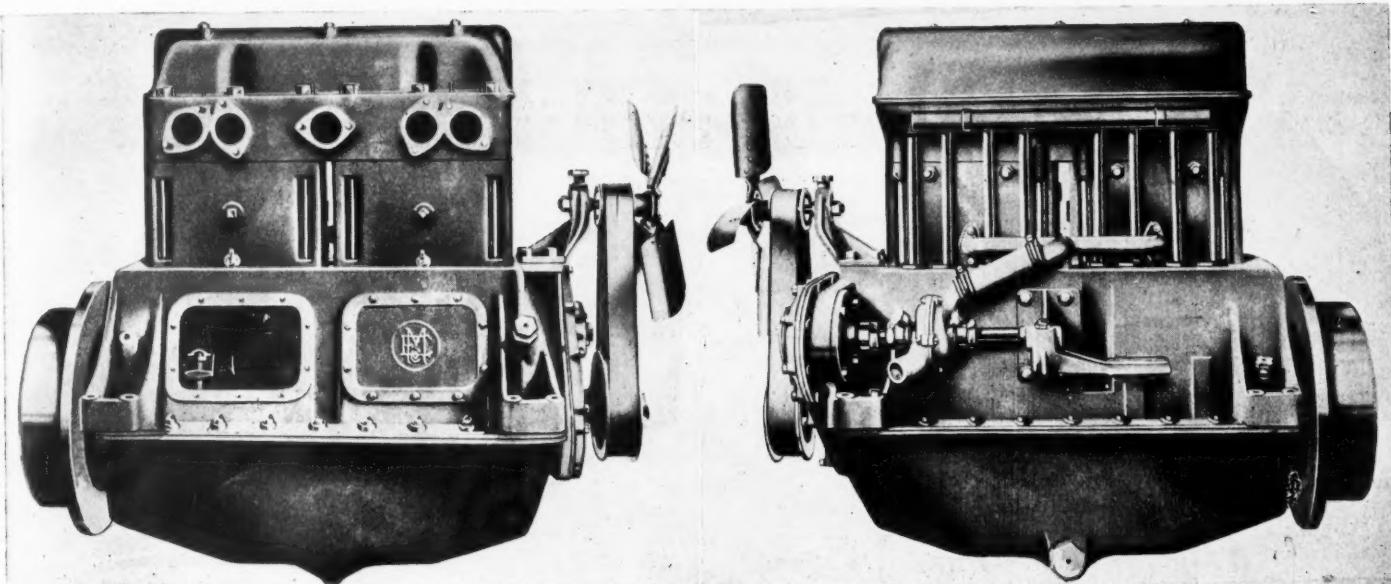
made of two iron castings and is parted in a horizontal plane through the crank shaft axis. The cylinder blocks and cylinder head castings are held to the top half of the crankcase by eight "through" bolts valve springs and rocker arms are covered by a cast housing.

A very heavy three bearing crankshaft is used, the journals of the cranks for both the $4\frac{1}{2} \times 6$ and the 4×6 engines measuring 3 in. in diameter. The crankpins are of the same diameter, and the result is a connecting rod of rather unusual form, the big end bearing being remarkably large as compared with the top end of the rod.

Lubrication of the crankshaft bearings is entirely by force feed, the oil being fed by a self-priming gear pump. An automatic, vacuum control led relief valve, which is located at the front main bearings, regulates the oil pressure in accordance with the load on the engine, instead of in accord-



Transverse and longitudinal section of the Midwest tractor engine



Two views of Midwest tractor engine

ance with the engine speed. This obviates difficulty from over-lubrication and consequent spark plug fouling and smoky exhaust at low loads. The oil leads to the bearings are so located that the oil enters at the point of minimum bearing pressure.

The usual breather on the crankcase has been eliminated, and instead the 8 tubes surrounding the pushrods act as breathers, balancing the pressure in the crankcase and in the valve housing. This at the same time provides a mist of lubricant for the valve mechanism.

Water is circulated by a centrifugal pump with a bronze runner cast onto the shaft in such a way that it cannot come

loose. Lengths of rubber hose are inserted in all water connections to eliminate strain due to vibration and weaving of the tractor frame. Ample water spaces are provided, especially around the exhaust valves, and there are three water outlets from each cylinder block, exactly over the exhaust valves.

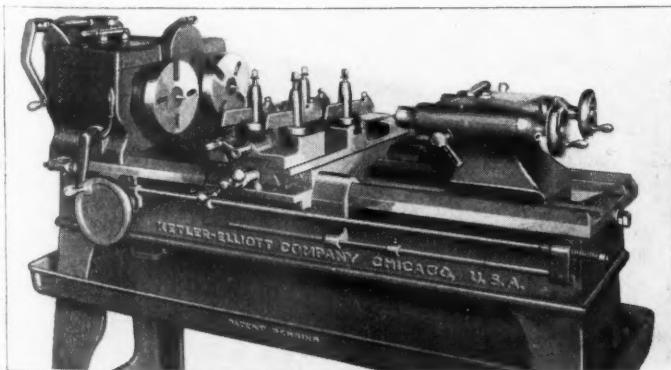
Among the features of construction may be mentioned the connecting rod bearing, which is cast in the rod, the bearing metal being thrown centrifugally into the forging itself. Neither shims nor oil grooves are used in the bearings. The valves have a clear diameter of $3\frac{1}{4}$ in., which is equal to 50 per cent of the cylinder bore. The engine is said to handle any fuel commonly used in tractor practice.

The Duplex Spindle Production Lathe

THE illustration is a duplex spindle production lathe, manufactured by the Ketler-Elliott Company. This lathe has two pairs of spindles, and works on two pieces simultaneously. It is particularly adapted for work

work and back tools for necking and undercutting operations, the double cross slide being provided with two wide tool posts, having T slots to receive gang tools. The carriage is operated by main and individual cross screws, which permits separate adjustments.

Dead stops are furnished for turning and recessing operations. The standard screw feed is used for the carriage and is fitted with an automatic knock-out rod and a dead stop for distance turning. The quick return of the carriage is also provided for. The head is of the selective type, self-contained, with extra heavy spool gears running in oil. A gear-shifting lever is conveniently located on top of the head. The spindles are designed to permit the use of pneumatic chucks.



The Duplex spindle production lathe

which cannot be turned on automatic screw machines because of its length, and for work which has to be centered for a final grinding operation. The carriage provides for a number of tools for straight or tapered

SENATOR J. E. RANSDELL, president of the National Rivers and Harbors Congress, in presenting his annual report to the fifteenth annual convention of the Congress at Washington, said that it would take an appropriation of more than \$4,000,000,000 to enlarge the railroad transportation system of the country to meet the transportation needs of the next decade, but would take only about \$500,000,000 to develop waterways of the country to meet the same need by supplementing rail transportation.

Valve Failures and Valve Steels

This paper, read by Mr. Aitchison before the Institute of Automobile Engineers, takes up the various causes of valve trouble and then describes the properties of ideal valve steel. He brings to light some interesting experiments that have been made in an attempt to obtain those properties and indicates the best methods of selecting suitable valve steel.

By Leslie Aitchison, D. Met.

BEARING in mind the high working temperature of the valves, it is of some importance to consider the ways in which a valve may get rid of its heat, as this action may be considered to control the temperature of the valve. As the temperature of the valve is highest in the head, this part of the valve is the most vital. There are three distinct ways in which the heat may be removed from the head of a valve:—(1) by being conducted down the stem of the valve and lost by way of the guide, etc.; (2) by direct radiation from the back surface of the head or the neck of the valve; and (3) by direct conduction from the face to the valve seat. Experiments have shown that by far the greatest proportion of the heat from the head is removed by the third method, i. e., by conduction through the face, and it is essential that this mode of cooling be examined most carefully. In this method, the dispersal of the heat is effected by the direct metallic contact of the valve head with the valve seat.

For proper cooling two things are essential, first, that the two surfaces shall come accurately together, and, second, that the valve shall be closed at the moment of ignition. The most prolific causes of trouble in valves are undoubtedly those produced by pre-ignition in the cylinder. If the valve is not properly seated at the time of the explosion, then there is bound to be a rush of gases round the valve, and this will take place at the time that the gases are near to their maximum temperature. Under these conditions the cooling of the head of a valve is interfered with and harm is bound to ensue. The author has examined valves which have failed in consequence of pre-ignition and which must have been raised to a temperature of at least 1150 deg. C. during the process.

Although the amount of heat lost by the other two channels is not a very high proportion of the whole, it is desirable that attention should be paid to them, as their effectiveness may represent just that small amount which makes the difference between success and failure. Cases have been examined in which the exhaust ports of an engine were so arranged that the exhaust gases played directly upon the valve stem near to the neck. In consequence, the neck of the valve became seriously overheated, becoming, indeed, a good deal hotter than the head. Under these conditions heat was actually being supplied to the valve head by the stem instead of being taken from it. The result in these engines was that the valves were burning out regularly. It is also of some importance that the valve guides, which help in the removal of the heat from the stem of the valves, should act efficiently. If they are so long that they jut out into the exhaust pocket and become heated in themselves, it will be difficult for them to exercise their functions in the proper way. The provision of a sufficient clearance between the stem and the guides is of equal importance.

Another factor in the conditions governing the working of the valves—the wear between the guides and the stem of the valves—varies in the different types of engines. In rotary en-

gines the path of the valve head is by no means rectilinear, and there is a very distinct sideways thrust produced by the inertia of the rotating system.

TYPES OF FAILURES OF VALVES

There are many ways in which valves actually fail. They may be codified as follows:

1. Elongation of the stem of the valve.
2. Distortion of the head of the valve.
3. The presence of cracks in the valve face.
4. Excessive wear of the valve stem.
5. Excessive wear of the valve foot.
6. Burning out of the head.
7. Scaling of the valve.
8. Breaking of the head or neck due to self-hardening.

Elongation of the stem is not a frequent cause of trouble; when it does happen it indicates one of three things, namely (1) the employment of a steel of insufficient strength at the working temperature, (2) overheating of the stretched part, or (3) an unsatisfactory design of the neck of the valve. Cases are on record where the stem stretched $\frac{1}{8}$ in. during a few hours' running, usually in the neck of the valve, this part being narrowed considerably in the design. Overheating of a portion of the stem is generally a consequence of an unsatisfactory design of the exhaust pockets or of the valve guides, in the first case causing heat to be delivered to the stem of the valve, and in the second case preventing the proper flow of heat from the head. A constriction in the neck causes stretching for similar reasons. The mass of metal here is less than at either side, and consequently becomes heated more rapidly. The cross sectional area for conduction of heat from the head is also smaller, and consequently this part becomes heated. Occasionally, stretching of the stem is caused by excessive scaling.

In one engine a serious number of failures occurred through the distortion of the head, which were traced to the fact that the forgings which were used had not been heat-treated and the valves went into the engine without any of the strains produced by the forging operation having been removed. When the valve became heated in consequence of the running of the engine, these strains were released and the valve warped, preventing it seating properly. When once the valves did not seat properly their destruction was only a matter of time. It is essential that valve forgings should be heat-treated most carefully to remove the strains produced by forging. This might be done by a simple process of normalising if a suitable steel were employed, but it can be done just as well by hardening and tempering if the tempering is done at a suitably high temperature.

Distortion of the head of a valve may occur even if the forging has been properly heat-treated before being put into the engine. If the valve is so placed that the head is unequally

treated, then this inequality of temperature may have a distortion effect. Sometimes this trouble can be overcome by utilizing a design which allows the valve to rotate during the running.

A further cause of distortion in the head of the valve is the undue or exceptional softening of the steel during running. If this happens, the valve may easily be pulled out of shape by hammering against the seat and tend to be pulled through by the spring (umbrella closing action). The causes of the softening are twofold, either the employment of a steel which is not sufficiently strong at high temperatures, or else the utilization of a design in which there is not sufficient metal in the valve head.

This should be considered definitely as a steel fault. The cracks may have been present in the steel bar from which the valves were made, or they may have been produced during the operation of drop-forging the valve. They are frequently very minute, and require most careful examination if they are to be discovered.

Occasionally the cracks are produced in the valve head during actual running. If an air hardening steel is used there is always a possibility that the temperature of the steel will rise above its hardening temperature when in the engine, and on cooling small cracks may be set up along the face.

From whatever cause the cracks may come, they are dangerous, because even the most minute crack will allow some of the compressed gas to percolate into it, and this sets up a destructive action on the steel. As a result of this action it is not uncommon to find a chunk of the valve head bitten right out, the gases having eaten away into two contiguous cracks which have then joined up, with the result that a portion of a valve has been blown right out.

This action occurs most frequently in rotary engines and must necessarily be provided against by the selection of a suitable steel. In general, the stem of a valve (at any rate, over the greater part of its length) does not become heated to a higher temperature than 400 deg. C., and there should be no difficulty in choosing a steel which will wear satisfactorily under these conditions.

This trouble is usually found in those valves in which the blow of the tappet is delivered directly on to the foot of the valve or in which the cam acts directly on the valve stem, no cap being fitted to take the blows or the wipe. In valves which are designed in this way it is usual to attempt to provide against excessive wear by completely hardening the valve on the foot only. This necessarily requires the use of a suitable steel.

No valve should be put into an engine in which the head has not been fairly thoroughly softened, and hence in a valve in which the wear has to be taken by the foot it is necessary to have one short piece of steel in two different conditions of hardness at opposite ends. This condition of affairs is not always very easy to arrange, and therefore it is not uncommon either for the foot of the valve to be softer than is intended, or else for it to have been hardened so drastically that it cracks. To avoid this trouble it is necessary to use a steel which hardens very simply or else to make such a design that the valve foot can be fitted with a suitable threaded cap.

BURNING OUT OF THE HEAD

Burning out may be due to several causes, and, as stated above, these are not entirely attributable to the steel. It is much more nearly true to say that in all cases where burning out occurs, the engine has been running badly. Pre-ignition or bad timing is a very frequent cause of burning out.

Apart from the running of the engine, other conditions may enter and one of the principal ones is oxidation or scaling of the steel. Cracks in the valve face are a very prolific source of burning out. If a valve does not seat properly, then burning out is almost certain to result. There is such a flow of hot gases round the valve that the temperature attained is higher than it should be, and, in addition to this, the valve does not come into proper metallic contact with the seat, and is, therefore, unable to cool itself properly.

Scaling most generally takes place either on the back surface of the head, or else on the neck or lower part of the stem. Burning out depends upon the temperature and also upon the steel itself. If a valve becomes scaled, the scale is likely to become detached in consequence of the vibration and then fall

away. If it happens to fall on a part which is already strongly heated, it may assist in the further scaling of the valve at that particular point. If the scaling occurs near the face of the valve, or if any scale happens to drop on this part, the valve will seat badly, and allows the exhaust gases to escape. Bad seating also means that the valve cannot cool itself in the proper manner, and therefore the temperature of the head becomes still higher. In either case the amount of scaling rapidly increases until the valve head is quite eaten away near to the danger point.

BREAKING DUE TO SELF-HARDENING

Various cases have been known in which a valve has worked satisfactorily for a certain length of time, and then has failed by the breaking up of the head, or the snapping of the neck of the valve. This happens most frequently when re-starting an engine and with valves manufactured from air hardening nickel chromium steel. The valves during the first running have been heated to a temperature greater than, say, 750 deg. C., and then allowed to cool down. As a result of this cooling, they acquired a certain amount of brittleness. Cracks also may have been produced during the process of hardening during cooling in consequence of slight irregularities of the surface. The properties of ideal valve steel are:

1. The greatest possible strength at high temperatures.
2. The highest possible notched bar value.
3. The capacity of being forged easily.
4. The capacity of being manufactured free from cracks, whether these arise in the manufacture of the steel bar or whether they are produced during the forging of the steel.
5. The capacity of being heat-treated easily, regularly, and reliably.
6. The least possible tendency to scale, and if scaling does occur, the scale should be as adherent as possible.
7. The ability to retain its original physical properties after frequent heatings to high temperatures followed by cooling to normal temperature, also after being heated to a high temperature for a considerable length of time.
8. No liability to harden when cooled in air from the temperature which it will attain when used normally as a valve in an engine.
9. The capacity of being heat-treated after forging so that it is free from strains liable to produce distortion.
10. Sufficient hardness to withstand excessive wear in the stem.
11. The capacity of being hardened at the foot of the stem with considerable ease if necessary.
12. The capacity of being machined easily and satisfactorily by ordinary methods.

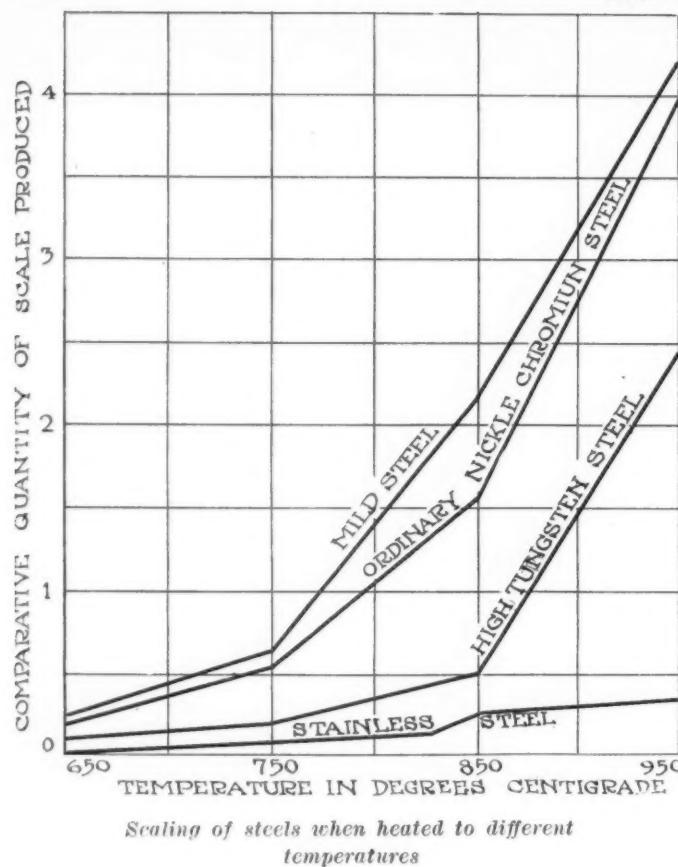
Various proposed steels are:

1. Tungsten steel of various compositions, ranging from 10 to 18 per cent tungsten and from 0.2 to 0.7 per cent of carbon.
2. High chromium steels of different kinds, ranging from 7 to 14 per cent of chromium, from 0.25 to 1 per cent of carbon together with varying proportions of silicon, nickel and cobalt.
3. 25 per cent nickel steel.
4. Steels containing 3 to 5 per cent of nickel together with chromium varying from 0 to 1.5 per cent, and carbon from 0.15 to 0.65 per cent.

In table 1 are shown the compositions of the various steels, corresponding to the different

Table 1.

Steel	Carbon	Nickel	Chromium	Tungsten	Cobalt	Vanadium
a	0.65	.....	3.5	17.0	...	0.8
b	0.60	.....	3.5	14.0	...	0.8
c	0.25	.....	3.5	11.5	...	...
d	0.30	25.0	.....	...	...	...
e	0.35	.....	13.0	...	...	...
f	0.70	.....	11.0	...	...	...
g	0.80	.....	7.0	...	...	...
h	0.35	3.0	.....	...	...	...
j	0.60	3.0	.....	...	...	...
k	0.30	3.75	1.0	...	...	...
l	0.30	4.25	1.4	...	...	...
m	0.15	3.75	1.0	...	...	...
n	0.10	5.8	0.25	...	...	...
o	0.30	.....	.....	...	...	...
p	1.0	0.5	11.5	...	4.0	...



groups given above. In order to be able to evaluate the various steels, a large number of tests have been carried out upon steels of all the compositions in the above list, throughout the working range of temperatures attained by the valves during running. These tests have been mainly tensile tests, but notched bar tests also have been carried out at high temperatures, and in some cases Brinell hardness tests. An examination has also been made of the extent and manner in which different steels scale. The result of these test are shown in the following tables.

CONSIDERATION OF EXPERIMENTAL RESULTS

The facts which emerge from the experimental results shown above appear to be as follows:—

1. That the principal factor in deciding the properties of a steel at high temperatures is its type. By this is meant that all the tungsten steels have fairly similar properties, while all the chromium steels have fairly similar properties among themselves, but different from the tungsten steels.

2. That there is a considerable similarity as regards mechanical properties at high temperatures between those steels which have a similar constitution. The high tungsten steels possess in most cases a structure which consists of a solid solution of iron, tungsten and carbon, together with some free carbides. The chromium steels do not possess this structure unless the carbon content rises beyond about 0.7 per cent. When that carbon content is reached the steels possess a structure which consists of solid solution more or less completely decomposed (according to the heat-treatment the steel has received), together with free carbides. The result is that the high carbon chromium steels have properties distinctly similar to the high tungsten steels.

3. That among the different steels in any type, variations in composition have a distinct effect upon the mechanical properties at high temperatures. This is particularly true of the high tungsten and the high chromium steels, in which a variation in carbon content produces a very marked effect upon the tensile strength or upon the notched bar value. This variation is also noticeable in the 3 per cent nickel and 3 per cent chromium steels, but is not so marked as in the steels containing a larger proportion of alloying elements. In these

steels a variation of 0.2 per cent of carbon, will have a greater effect upon the strength than a variation of 5 per cent of tungsten or even 7 per cent of chromium.

4. That the tungsten steels with the high percentages of carbon (i. e., about 0.6 per cent) have the greatest tensile strength at high temperatures. This strength is most nearly rivalled by that of the high chromium steels containing a high percentage of carbon.

5. That steel containing a high percentage of chromium with a lower percentage of carbon (e. g., stainless steel) is distinctly weaker than either the high tungsten steels or the steels containing a similar proportion of chromium with high carbon.

6. That the plain nickel or nickel chromium steels are quite weak at high temperatures as compared with the other steels. Variations in composition among these steels have apparently very little effect.

7. That the influence of vanadium on the properties of the tungsten steels at high temperatures appears to be negligible.

8. That steels containing cobalt appear to possess no superior properties at high temperatures over those free from cobalt.

GENERAL PROPERTIES OF VALVE STEEL IN USE

9. That the high chromium steels present the greatest resistance to scaling at high temperatures of any of the steels. Those of the "stainless" type give a very high resistance, while those containing about 7 per cent of chromium give a very fair resistance, though not quite so good as that of the stainless steels. In the latter case, however, the scale is more adherent than in the case of the stainless steel type.

10. That the nickel chromium steels scale to a greater extent than do the steels of any of the other types.

11. That the tungsten steels scale comparatively little up to temperatures of about 850 deg. C., but beyond that they are liable to scale very considerably.

12. That the notched bar values of the various steels at high temperatures vary considerably, but are a reasonable index of the tensile strength of the steel, being more or less inversely proportional to this property. The notched bar tests show the effect of variations in carbon content quite as markedly as do the tensile tests, those steels containing a high percentage of carbon having very much smaller notched bar values even at high temperatures than those with a low percentage of carbon. In all cases the notched bar value is very much higher for steel at elevated temperatures than it is when the steel is cold.

It is now possible to examine the various types of steels to see how far each of them possesses the properties of the ideal valve steel asset out above. Each of the twelve properties of the ideal valve steel enumerated above can be considered separately and the different steels which have been in use examined to see how far they possess the property of the ideal. For this purpose the author will consider only the most representative steels, i. e., the ones which are most satisfactory in each group. These appear to be as follows:

- Tungsten steel containing tungsten not less than 14 per cent and carbon about 0.6 per cent.
- Chromium steel containing about 13 per cent of chromium and about 0.35 per cent of carbon.
- Steel containing from 7 to 12 per cent of chromium and about 0.6 per cent of carbon.
- Steel containing about 3 per cent of nickel.
- Ordinary nickel chromium steels.

1. With respect to tensile strength at high temperatures the steels can be placed in the following order:—

High tungsten (a).
High chromium, high carbon (c).

High chromium, low carbon (b).

3 per cent nickel and nickel chromium steels all the same.

2. As the temperature increases the notched bar value rises very much more rapidly than the tensile strength falls.

3. The order in which the steels should be placed, in respect to ease of forging, is almost exactly the reverse of the order of excellence as regards strength. The 3 per cent nickel steel is probably the most easily forged, the nickel chromium steels

the next, while the high chromium and high tungsten steels are all rather poor.

4. The ease of manufacture free from cracks places the steels in exactly the same order as under clause (3).

5. In respect of ease of heat-treatment, the high chromium steels probably come first, although the tungsten steels are very easy to treat. The chromium steels are air hardening, therefore, can be heat-treated simply by heating to a temperature of about 900 deg. C. and cooling in air, after which they can be tempered at a temperature up to about 750 deg. C. The tungsten steels should be softened completely by tempering at a temperature of about 800 deg. C., and this operation is facilitated by refining or normalizing the steel by heating to a temperature of 950 deg. C. previously, followed by cooling in air. The nickel steels and most of the nickel chromium steels require to be hardened in oil from about 830 deg. C. and tempered at a temperature of about 600 deg. C. subsequently. Some of the nickel chromium steels can be hardened in air from a temperature of about 800 deg. C. and tempered at about 660 deg. C. As explained below, however, steels which can be treated in this manner are not to be recommended.

RETENTION OF PHYSICAL PROPERTY

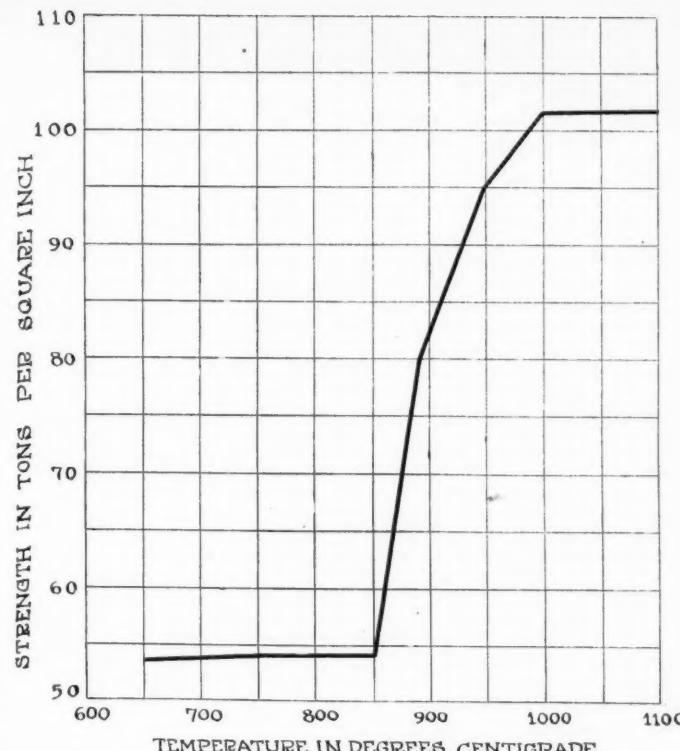
6. With respect to scaling, the advantage here lies very strongly with the chromium steels. The high chromium steel with low carbon (b) scales very little indeed, and the high chromium steel with a moderate percentage of carbon scales very little more, while it is a distinct advantage that the scale on the latter steel is very adherent. The tungsten steels scale much more than the chromium steels, but not quite so much as the nickel and nickel chromium steels.

7. With respect to the retention of physical properties, this depends entirely upon the temperature to which the steel is heated during work. *It should be taken as an axiom for valve steels that the temperature to which steel is to be heated when running in the engine should not be any higher than the temperature at which the steel is tempered during its heat-treatment.* If this rule be observed as far as possible (although it cannot be for valve work at temperatures over 800 deg. C.), then the tungsten steel may be considered to have a very considerable excellence in this respect. The chromium steels are about as good, but the nickel chromium steels probably suffer some change of properties, in particular the notched bar value falls away. The nickel steels retain their physical properties quite well provided that the rule enunciated above is closely observed.

8. The steel which is employed should not harden when cooled in air from its running temperature. This strictly limits the application of the various steels. Tungsten steels harden a little, but not very much when cooled from a temperature of 850 deg. C. (see Fig. 11). If the steel is heated to 900 deg. C., then it hardens distinctly, but by no means as much as it would if heated to the higher temperatures. On the other hand, the chromium steel is completely hardened by cooling in air from a temperature approaching 900 deg. C. It actually hardens appreciably when cooled from a temperature of about 840 deg. C., the critical temperature being about 820 deg. C. The nickel steels probably do not harden at all. On the contrary, they become quite soft when heated to any temperature appreciably higher than their tempering temperature (e.g. to 700 or 720 deg. C.). The nickel chromium steels in some cases are distinctly air hardening, and the temperature above which they will harden in air is not very high. If a nickel chromium steel is heated to a temperature of 750 deg. C. and cooled in air it will be distinctly hardened. All the nickel chromium steels are not air hardening, but when they are then the conditions stated above hold good.

9. Freedom from distortion generally can be obtained more easily in those steels which are air hardened than in those which are oil hardened. There is relatively little to choose, however, among the different steels with respect to this particular property.

10. Wear in the stem is a trouble which hardly ever arises with the tungsten steels, since even after being softened at 800 deg. C. they have a hardness corresponding to a tensile strength of approximately 55 tons per sq. in. On the other hand, the chromium steels (b) have often given rise to a con-



Curve showing variations of hardness of tungsten valve steels after cooling in the air from different temperature

siderable amount of trouble, since when suitably heat-treated they have a tensile strength in the region of 40 tons per sq. in., and are liable to wear considerably. The nickel steels and nickel chromium steels experience this trouble in proportion to the strength which they possess after the heat-treatment to which they have been subjected. In this property the tungsten steels have a general advantage.

TUNGSTEN STEEL

11. As regards the case of hardening on the foot, the tungsten steels have been heat-treated in this way more than any of the others, but it is doubtful whether they are the most suited to this treatment. In order to harden these steels really effectively, they have to be heated to a fairly high temperature, and consequently the details of manipulation are not so simple as with the steels which can be treated at lower temperatures. The chromium steels are by far the most satisfactory for this treatment, assuming always that the air hardening nickel chromium steels are not going to be used in consequence of the possibility of their hardening in the engine during running. The foot of the valves in the high chromium steels can be hardened effectively by heating to a temperature of about 860 deg. C. (which is lower than should be employed for the tungsten steels) followed by cooling in air. The nickel steels cannot satisfactorily be treated in this way, as they require to be quenched in a liquid, and this is invariably awkward.

12. Ease of machining is, of course, a particularly important factor in choosing a valve steel. In this respect it is probable that the high chromium, low carbon steel (b) is by far the most simple to treat, while the straight nickel steels come next. Tungsten steels should not give trouble provided that they are properly heat-treated, and the same remark applies to the high chromium, high carbon steels. In the latter steel, however, unless the carbon is kept below 0.7 per cent, there is a likelihood that a considerable amount of trouble may ensue. The nickel chromium steels only can be machined satisfactorily if they have been correctly heat-treated, and they are quite liable to be difficult to machine unless the tempering temperature employed has been fairly high.

In Table XVII is given a synopsis of the above discussion of properties for easy reference. The steel possessing the desired property in the greatest degree is marked 1, and the worst steel 5, etc.

TABLE XVII
General Properties of Various Valve Steels

Property.	High Tungsten, high carbon steel.	High Chromium, low carbon steel.	High Chromium, high carbon steel.	3 per cent Nickel Steel.	Nickel Chromium Steel.
Tensile strength at high temps.....	1	3	2	4	4
Ease of forging	4	3	4	1	2
Ease of sound manufacture	4	3	4	1	2
East of heat-treatment	2	1	2	4	3
Scaling	3	1	2	4	4
Retention of physical properties.....	1	2	2	3	4
Self-hardening in running.....	2	3	4	1	5
Freedom from distortion.....	1	1	1	2	2
Wear in stem.....	1	3	1	2	2
Hardening in the foot.....	2	1	1	3	3
Ease of machining.....	3	1	5	2	4

SELECTION OF THE MOST SUITABLE STEELS

Summarizing the results which have been set down above in full it should be possible to indicate to the enquiring engine designer what steel should be employed by him for the valves in his engine—whatever may be the conditions under which the valves have to work. The following appears to the author to be the most reasonable selection of steels from that list:

- (1) A tungsten steel.
- (2) A high chromium steel.
- (3) A nickel steel.

The list contains no nickel chromium steel, and this omission is considered to be just for several reasons. Firstly, the nickel chromium steels have no superiority in mechanical properties at high temperatures over the plain nickel steels. Secondly, the nickel chromium steels are more difficult to manufacture free from flaws, and also they are more difficult to forge in a perfectly sound condition than the plain nickel steels. Thirdly, many of the nickel chromium steels are air hardening and tend to harden up in the engine during running, producing the possibility of cracks and fracture. For these reasons it seems quite unnecessary to use a nickel chromium steel when a plain nickel steel will do all that is required just as well or better.

The nickel steel is put into the list because of its numerous advantages and because it is desirable in many cases to use a good quality steel which can be obtained fairly cheaply. The price of nickel steel is about a quarter of that of the chromium steel and about an eighth of that of the tungsten steel. As it has only a relatively low strength at high temperatures, nickel steel should be employed only for those valves which are not raised to a very high temperature, nickel steel should be employed only for those valves which are not raised to a very high temperature during the running of the engine. The upper limit of temperature to which it should be exposed is given by the tempering temperature used in the heat-treatment of the steel. This is never likely to be more than 650 deg. C., and the working temperature therefore should be kept below this. Making the most careful selection from the different steels which have been tested, the following composition would appear to be the one most likely to give satisfaction.

Carbon 0.30 to 0.35 per cent
Nickel 2.75 to 3.75 " "
Manganese 0.40 to 0.70 "

Such a steel can be conveniently heat-treated by quenching in oil from a temperature of about 830 deg. C. and tempering at a temperature of about 625 deg. C. The mechanical properties which it will possess after this treatment are approximately as follows:

Ultimate strength..... 48 tons per sq. in.
Elongation 20 per cent
Reduction of area 45 per cent
Izod impact 45 ft.-lb.
Brinnell hardness number.... 220

Such a steel can be used conveniently for all inlet valves and can be employed for the exhaust valves of the coolest

engines—e. g. most rotary aero or most touring automobile engines.

The high chromium steel is justifiably included in the list—though it may be any of several steels of considerable variety of composition. The general advantages to be urged for this steel are (1) that it is very resistant to scaling, this property being more or less common to all the chromium steels containing more than about 6 per cent of chromium; (2) that it can be heat-treated very easily in virtue of its air hardening properties; (3) that if the low carbon material be employed then the mechanical properties of the steel at ordinary temperatures are such that the steel is quite easily machined.

Among the disadvantages of the steel are: (1) that it is not at all easy to manufacture free from cracks, (2) that it is not easy to forge, (3) that the low carbon variety (which is easy to machine at ordinary temperatures) is not very strong at high temperatures, whilst if the greater strength at high temperatures be obtained by raising the carbon content then the steel is rather too hard at ordinary temperatures to be machined really easily.

The most suitable composition to use for the chromium valves appears to be approximately:

Carbon	0.65 per cent
Silicon	0.60 "
Manganese	0.50 "
Chromium	10.0 "

This steel should be heat-treated by being hardened in air from a temperature of about 900 deg. C., and tempered at a temperature of approximately 750 deg. C. It will then give roughly the following mechanical properties when cold:

Ultimate strength	58 tons per sq. in.
Elongation	16.0 per cent
Reduction of area	40.0 per cent
Izod impact	20 ft.-lb.
Brinnell hardness number....	269

This steel is too good for inlet valves, and, generally speaking, is unnecessarily expensive for the exhaust valves of the cooler rotary engines. It may be used advantageously in the exhaust valves of the hotter rotary aero engines or in the exhaust valves of the cooler running stationary aero engines, or in the majority of touring or commercial cars.

ALLOCATION OF THE DIFFERENT STEELS

The great value of the tungsten steel is that it retains, at high temperatures, a greater proportion of its strength at low temperatures than does any other steel. It is quite the strongest steel at high temperatures, and at the same time has such properties at ordinary temperatures as make it quite easily treated in the machine shop. As it is an expensive steel, it should be used only in the hotter engines (i. e. water cooled stationary aero or racing car engines) as exhaust valves, and as it is used in virtue of its superior strength at high temperatures it is preferable to employ steel of such a composition as will give the greatest strength under these conditions. A typical composition for the steel is

Carbon	0.65 per cent
Tungsten	16.00 "
Chromium	3.75 "

This steel should be heat-treated by being refined at a temperature of 950 deg. C., followed by cooling in air, and tempered (or softened) at a temperature of 800 deg. C. When the steel has been treated in this way it will possess approximately the following physical properties:

Ultimate strength	54 tons per sq. in.
Elongation	18 per cent
Reduction of area.....	35 per cent
Brinnell hardness number ...	248

Taking the above list of steels, the following allocation may be suggested:

All inlet valves	3 per cent nickel steel
Exhaust valves with a working temperature not higher than 600 deg. C.	3 per cent nickel steel
Exhaust valves with a working temperature between 600 deg. C. and 760 deg. C.	high chromium steel
Exhaust valves with a working temperature greater than 760 deg. C...	tungsten steel

A Temperature Control System for Commercial Use

The "Tag" temperature control system may be adapted to dry kilns, superheaters and to pressure regulation in its various aspects. The working of the system is made clear below by the use of diagrammatic sketches.

THE accompanying diagrammatic sketch illustrates the general theory of operation of what is known as the "Tag" temperature control, the name being a modification of that of the manufacturer's, C. J. Tagliabue Mfg. Co. The shape and size of the apparatus is changed to suit the varying conditions of commercial use, and in actual practice the different units are more compact.

Fig. 1 shows the application of the controller to the case of a tank heated by steam. Evidently, by governing the steam supply, the desired temperature can be maintained. What the makers call a diaphragm motor is used to regulate the steam valve, and is located just above the valve. In the upper portion of this so-called motor is a diaphragm, actuated by compressed air entering by way of the ball valve.

The position of the ball in the valve determines the amount of compressed air passing to the diaphragm motor to regulate the steam supply. Attached to the ball is a stem leading to the transmission lever. An adjusting post is the connecting link between this lever and the vapor capsule, in the tip of which is another diaphragm, actuated by the vapor within. The tension of this vapor is determined by the thermostatic bulb inserted within the tank. Thus the final link in the series of regulating devices is the thermostatic bulb.

Fig. 2 is a detail representation of the ball valve, the ball being shown in the intermediate position. Compressed air can enter, therefore, and part of it will be conducted to the diaphragm motor. As the ball stem does not fit tightly in the aperture through which it passes, a portion of the air can leak upward along the stem, unless the ball is in one of the extreme positions—either entirely up or entirely down. If the ball is entirely up, there is no leakage past the stem, and the full

pressure goes to the diaphragm motor and shuts off the steam. If the stem and ball are entirely down, no air can enter, and the steam valve is wide open. Such a condition exists when the tank is cold.

As the temperature rises, the liquid in the bulb vaporizes and establishes a pressure which corresponds exactly to the temperature. The action of the vapor is to force upward the capsule diaphragm and transmit the movement to the adjusting post, thus forcing the lever away from the ball valve and allowing the ball and stem to rise under the action of the compressed air. The compressed air then proceeds to the diaphragm motor and partly closes the steam valve. The position of the adjusting post determines the temperature at which regulation begins.

A system such as described, or a modification, can be used for a wide range of purposes. It can be applied to benzol stills, dry kilns, japanning ovens, superheaters, pressure regulation in its various aspects, gas condensers, water control, and so on.

Electric Heat for Molding Bakelite Articles

ACCORDING to an annual review of electrical development, by the Westinghouse Electric & Mfg. Co., electric heaters are now extensively used for heating molding machines used in manufacture of bakelite products, and it has been found that the superiority of electric heat over steam is very pronounced. The saving in rejected material also contributes to the success of the heaters used for this purpose.

One of the newest applications consists in applying steel-clad heaters to molding machines used in the manufacture of radiator caps for automobiles. A single press will mold 16 radiator caps at one time, each press being equipped with 8 steelclad heaters, rated at 625 watts each.

To produce clean, smooth castings from molds made with metal patterns, it is essential that there be no sticking of molding sand to the patterns upon removal from the sand. The collection of moisture largely responsible for this difficulty can be prevented by heating the pattern. Heating the mold by means of electric heaters obviates this difficulty.

Heretofore the armatures and field coils of electrical machines have generally been baked in ovens heated by gas. Recently electric heat has been applied to this purpose, and on account of its easy control, it is said to possess undisputable advantages. Exhaustive tests have been made by one of the large railway companies in competition with steam and gas, and it has been found that with electrical equipment results are secured that were heretofore unobtainable. They are furthermore convinced that the increased life of the armature, due to the proper baking, will offset the higher cost of electric power and apparatus.

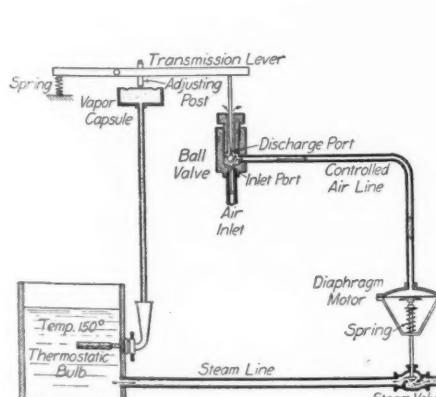


Fig. 1—Control system regulating temperature of tank

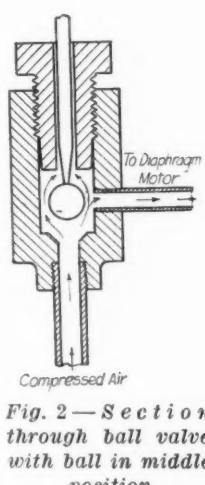
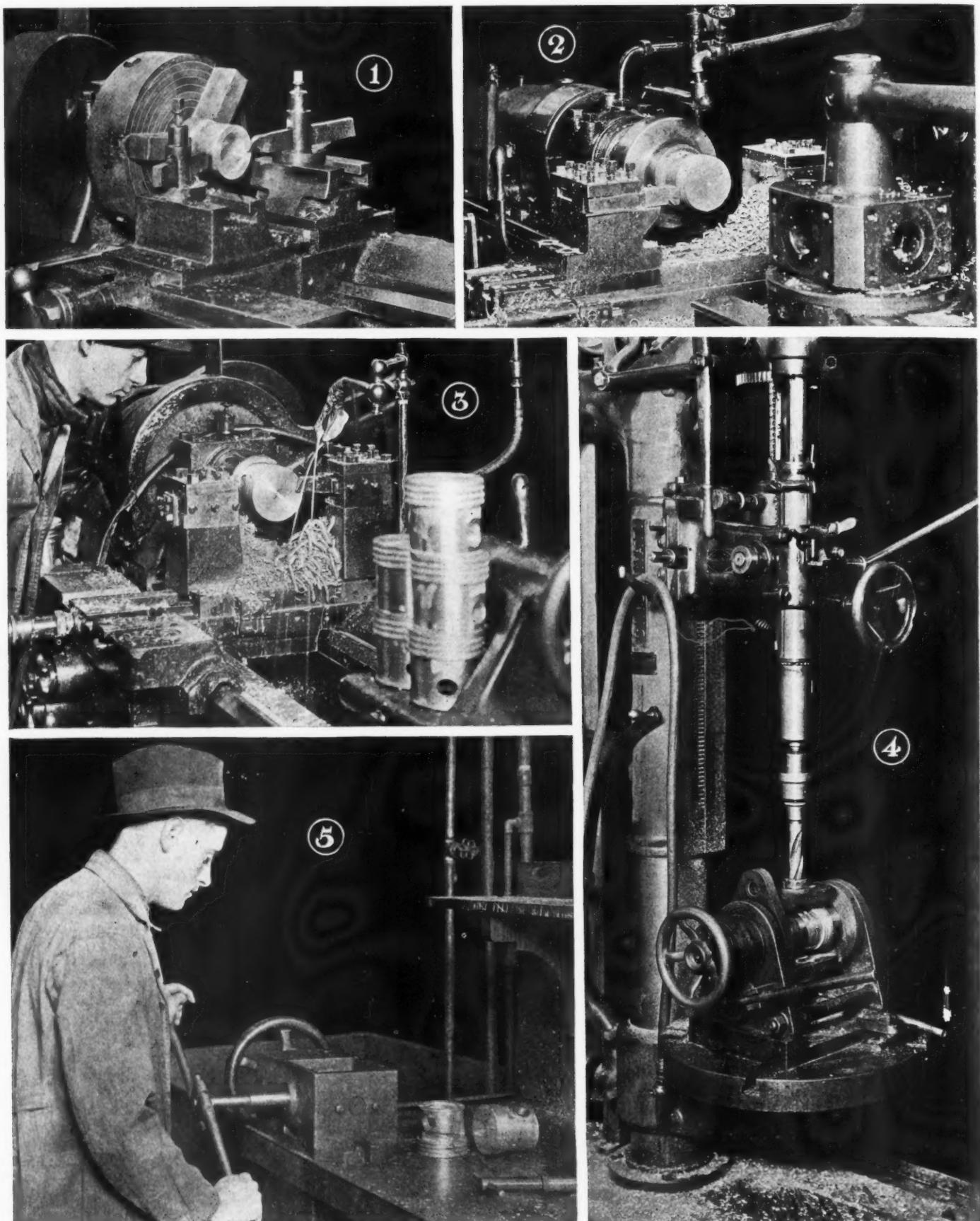


Fig. 2—Section through ball valve with ball in middle position



1. Piston upper half, turning location for following operation, facing lower end. 2. Piston upper half, rough turning outside diameter to 3.750 in. 3. Piston upper half, turning outside to size and facing piston head. Also, finish turning ring groove, using a three-tool post with two tools in rear. 4. Piston upper half, drilling the piston pin holes. 5. Piston upper half, hand reaming piston pin holes.

Manufacturing Methods for an Aluminum-Iron Piston

The different expansion of the two metals involved make this problem in the Marmon plant an interesting one and you will note the methods adopted to insure accuracy. In this case the part of the piston which is submitted to the heat of the explosion, and acts as a seal, is of aluminum while the sleeve is iron.

In the new Marmon cars an unusual piston is employed consisting of two parts, one of which is iron and the other aluminum. Because of this combination of two metals with different expansion rates and because of the necessity of accurate fitting, an unusual manufacturing problem is presented, which has been met in a manner which guarantees accuracy. This piston combines an aluminum heat radiating unit with an iron bearing unit.

The part of the piston which is submitted to the heat of explosion and acts as the seal, is of aluminum, while the sleeve which bears against the cylinders and performs the guiding function is of iron. The construction of this piston is such that the aluminum casting takes the explosion thrust and transmits it directly to the wrist pin, which has its bearings in bosses in the aluminum casting. Below the piston pin boss is a pilot which is fitted into a recess of the cast iron sleeve, which acts as the guiding and bearing unit.

The cast aluminum blank for the upper portion of the piston closely resembles a regular piston blank, except that it is short below the wrist pin boss. The blank is chucked in a lathe and the lower diameter turned, as shown in Fig. 1. This is a locating operation rather than manufacturing, and forms the basis of location for all of the following operations: The piston on the subsequent operations is chucked from the interior with the lower face—which has been turned accurately to a plus or minus 0.001 in. limit—brought flush against the face of the chuck by means of a drawbar device. The piston is put in a Potter & Johnson, as shown in Fig. 2; the outside is rough-turned to 3.750 in., plus or minus 0.005 in., and the ring grooves are also rough turned.

Finish cutting the grooves is done on a Credes & Klusman lathe, the same type of drawbar chuck being used as in the previous operation. The finish cut on the grooves is done simultaneously. The groove width is cut accurately so that on the gage 0.1875 represents the go-side and 0.1885 the no-go-side. On this same machine the finish facing operation is completed, as is indicated in Fig. 3. Thus a three-tool post layout is required to do this work.

The piston pin holes are drilled on a Cincinnati radial drill, the work being located in a rotating fixture, as shown in Fig. 4. After the piston pin holes are drilled they are hand-reamed, as indicated in Fig. 5, and tested with a plug gage of which the go-side is 1.185 in. and the no-go 1.1855 in. The burrs left by the previous operations are removed by hand, and the pistons are then cleaned.

The bottom end of the aluminum part of the piston, which

seats against the iron portion of the unit, is lapped on a lapping plate, as indicated in Fig. 6. The lapping operation is very thoroughly done, the bottom being spotted on a surface plate, which is shown beside the lapping plate in the illustration. The lapping material is ground glass, and the amount of metal to be taken off in the operation is approximately 0.005 in.

Two 5-16 in. oil holes are drilled in the sides of the piston in a plane at right angles to the piston pin, the piston being located on a mandrel and the drill located in the fixture supporting the mandrel. This operation is shown in Fig. 7.

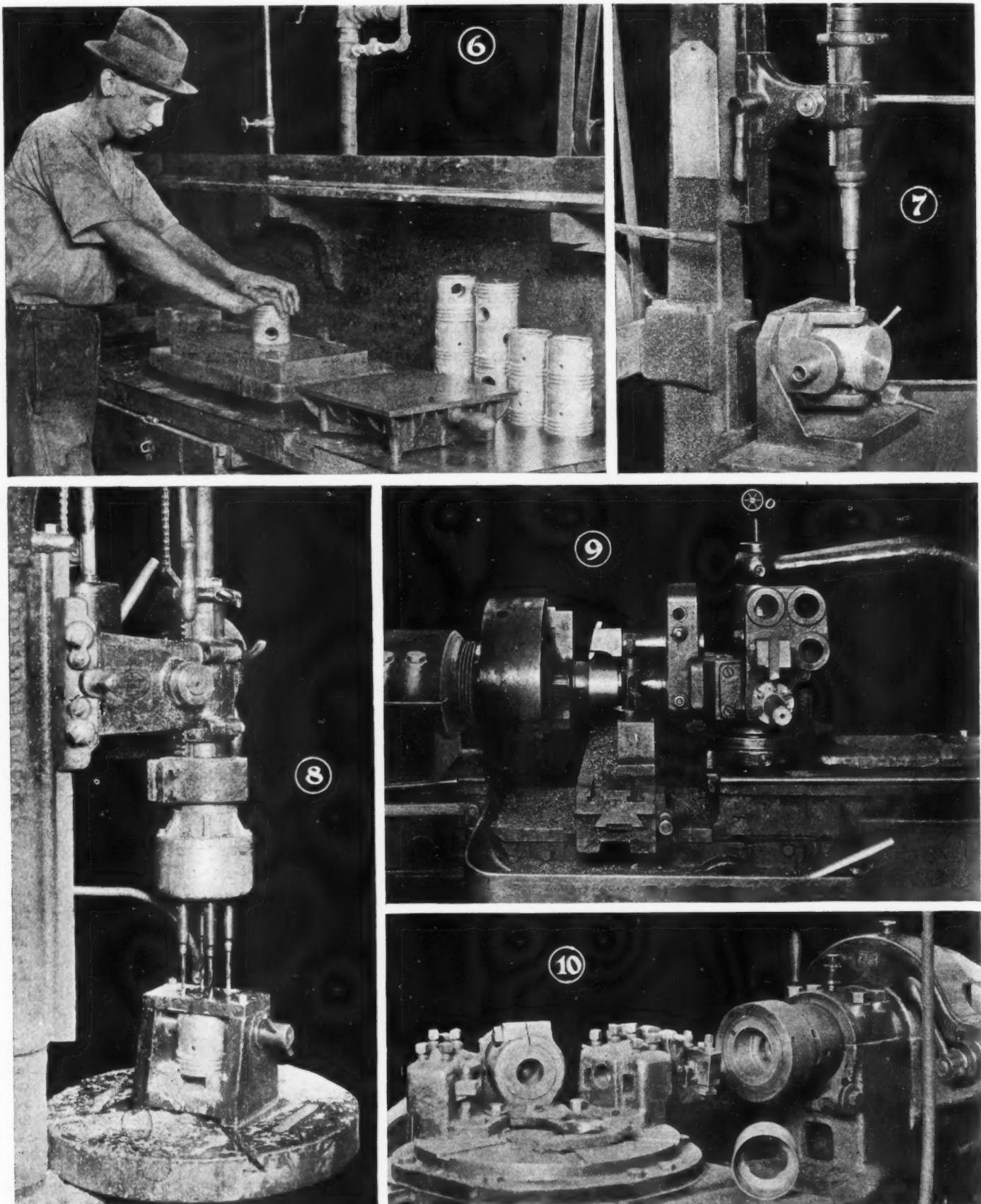
The studs for fitting the aluminum part of the piston to the iron part are mounted in the bottom flange of the aluminum part of the piston, these studs being screwed into the aluminum by means of a Garvin tapper. The holes for the stud were drilled before the surfacing operation and are very carefully located so that the studs are at right angles to the landing surface of the aluminum part of the piston.

MANUFACTURE OF THE IRON HALF OF PISTON

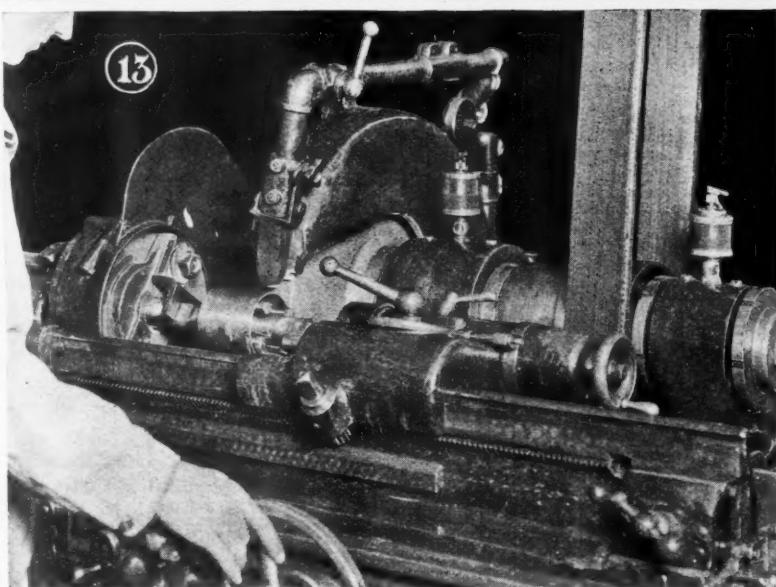
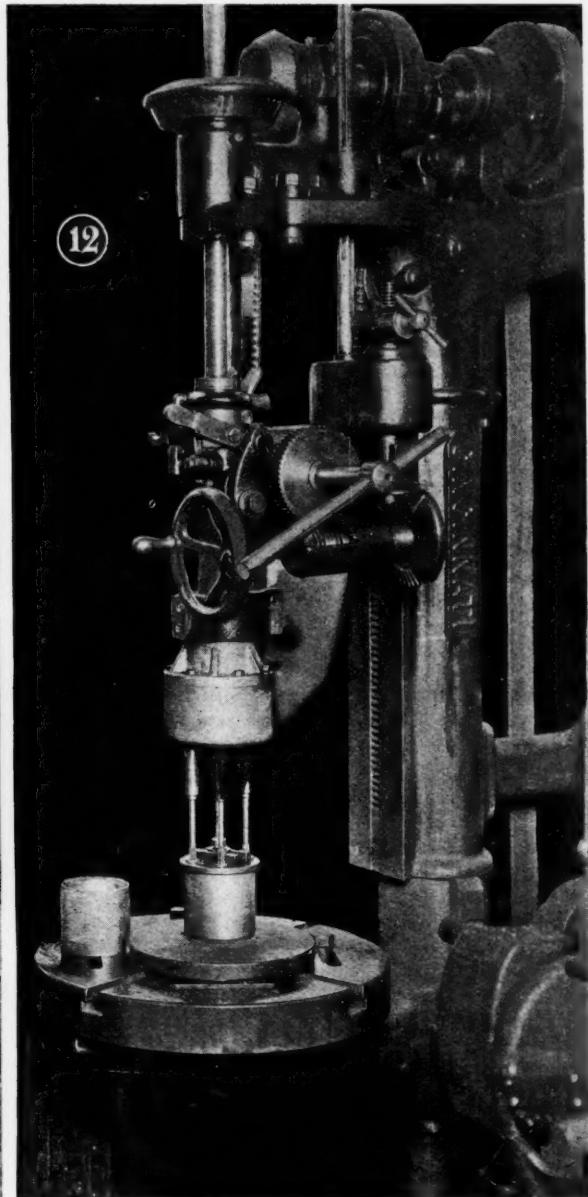
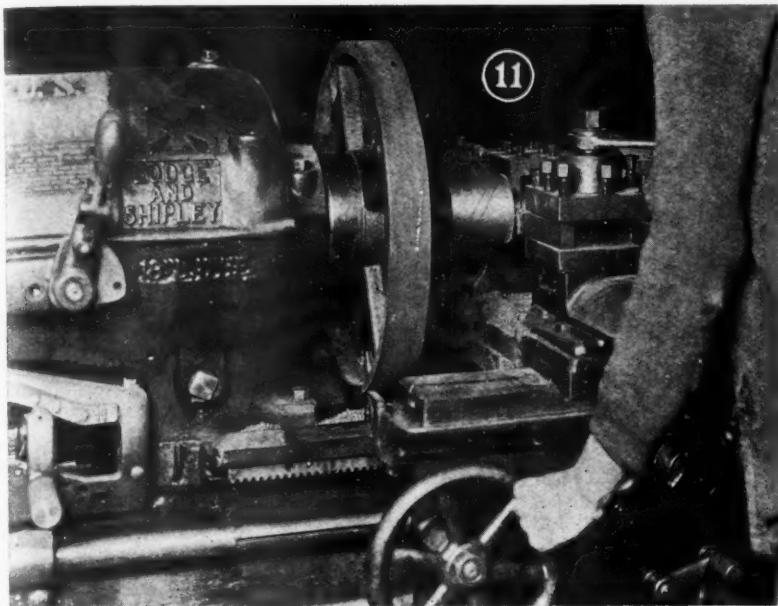
The iron or lower half of the piston is manufactured from a casting which originally weighs 5 lb. 2 oz., while the finished iron part of the piston weighs only 1 lb. 1 oz. The blank is a cylindrical piece of iron with an interior web against which the aluminum part seats. The first operation on the iron part of the piston is illustrated in Fig. 9. Here the piston is roughed out, a cut of $\frac{1}{8}$ in. being taken off the outside and $\frac{1}{8}$ in. inside. Also, the web, which forms a seat for the aluminum part, is turned off. This is done in a Potter & Johnson turret lathe.

Another of these lathes is utilized for rough turning the other side of the piston and the upper part of the web, after which the casting is annealed in an oven in which the temperature is brought to 1450 deg. The oven is then sealed and the castings are allowed to cool very slowly and uniformly to remove any internal stresses. After being annealed the chucking ring, which is part of the casting, is cut off by a straight tool and subsequent chucking operations are carried on by external chucks. The same Potter & Johnson machines that rough turned the casting before annealing are utilized for taking another rough cut and refacing the web. This is really the first sizing operation on the piston, the other operations being merely those intended to relieve casting strains and to properly locate the subsequent operations to bring the piston to size.

The casting is now chucked on an arbor on the inside, square with the web, and finish-faced to grinding size. This is done in a Lodge & Shipley lathe. The operation on the Lodge



6. Piston upper half, lapping and spotting skirt seat. 7. Piston upper half, drilling two 5-16 in. oil holes. 8. Piston upper half, drilling holes for four studs. 9. Piston skirt, roughing out iron casting for piston skirt previous to annealing. 10. Piston skirt, finish boring and turning to length



11. Piston skirt, finish turning. 12. Piston skirt, reaming four-stud holes through reaming plate. 13. Piston skirt, reaming four stud holes through reaming plate. 13. Piston skirt, finish grinding outside diameter.

& Shipley is illustrated in Fig 11, which shows the cutter finish turning the piston skirt.

Inasmuch as there is a web in the center of the iron skirt, it is necessary to work both ends independently on the boring operation, so that on the Acme machine the short end is first finish-bored and the web finish-faced. Then the casting is reversed and the long end finish-bored and the web on the long end side, finish-faced. On both of these Acme operations a special collar chuck is used to hold the casting, which has now been machined to a thickness of just a little over 1-16 in. This collar chuck takes in the whole skirt.

The holes for the studs which hold the skirt to the aluminum part of the piston are drilled simultaneously on a Cincinnati Bickford multi-spindle drill. A drill plate clamped to the top of the skirt is employed and the holes are then reamed on the same machine by means of a reaming plate which is located by means of two pins fitting into two of the drilled holes. After these holes have been drilled and reamed, the surface against which the aluminum part of the piston fits is checked on a lapping block. In case it does not spot up perfectly it is lapped in the same way as the aluminum part, but it has been found

that only one in twenty needs lapping. Each of the cast iron skirts is checked, however, by spotting up with Prussian blue and must pass a rigid inspection before passing.

The pistons are finished by grinding, a rough grinding cut being taken, first with a Norton 36-K carborundum wheel, with which the skirts are ground to plus or minus 0.001 in., about 0.004 in. oversize. The finish grind is taken with a Norton 24-CK alundum wheel ground to side and with the tolerances plus zero and minus 0.0005 in. After the finish grinding the skirts are washed and oiled. The accuracy of the assembly is very largely guaranteed by the ingenious method of locating on the grinding work. On the grinder there are locating studs which screw into the piston stud holes and the grinder arbor, so that after the wall is finished no eccentricity is permitted, the limit of zero being placed on this work. Assembly of the iron to the aluminum part of the piston does not take place until the parts reach the final engine assembly bench, inasmuch as it is necessary for the connecting rod to be put into place before the iron is fitted to the piston. Owing to the close limits of accuracy put on this work, the aluminum parts and iron parts are all interchangeable and do not require matching up before reaching the assembly stand.

Another Bill to Establish an Aeronautic Department

A study of this bill, which apparently has been well received in Congress, will reveal that it does not provide for as liberal a control of the future of aircraft as the friends of the industry had hoped would be given for it. The objection to this bill is that the authority is too much centered. The Postoffice Department is not recognized, although it is a large user of aircraft.

By Allen Sinsheimer

ABILL has been introduced into Congress by Congressman Morin to establish a Department of Aeronautics, which is the most satisfactory plan thus far introduced and is most likely to win the approval of the various government aeronautic authorities. Some features of this bill are not approved by students outside government circles.

The department would have such powers as would be prescribed by the President of the United States, whose authority would be unlimited in so far as development, production, operation or maintenance of aircraft are concerned. It would take over all funds appropriated for the various executive departments for aerial purposes, would control all matters pertaining to aerial traffic and navigation, and the promulgation and enforcement of the necessary rules and regulations and would appropriate and submit to Congress the estimates of funds to meet aviation requirements of all government departments, including the development of aircraft fields, shops and airdromes. The Director in turn would disburse the appropriations in amount fixed by law or as is directed by the President.

The procurement of all aircraft accessories, fields, shops and airdromes would be under the Department of Aeronautics, including the assignment of these materials and fields to meet the military, civil and commercial interests of the government. It would conduct all development work pertaining to aeronautics except for the military and naval forces, to which it would furnish the necessary facilities for the operation of their respective technical sections. The Director of Aeronautics would administer his office to best serve the requirements of national defense and to develop the aircraft and aerial industries.

The operation of aircraft would not be a function of the department except when directed by the President. This means that postal, naval and military aeronautics would remain under their present respective departments unless the President should direct otherwise.

A Board of Control would be established by the bill, consisting of three members representing the War, Navy and other government departments, which is intended to co-ordinate the aeronautical needs. The bill appropriates \$100,000 for the purpose of the act.

These features of the bill are not favored by all students of aircraft future:

Too much authority granted to the President.

Too little importance attached to the Post Office Department.

The establishment of a Board of Control, which itself would be without control.

The President is authorized by the bill to take over aerial operations of any department as he may deem necessary. This would grant him wide authority and would allow for misuse or perversion of aviation in this country, depending upon the individual at the White House.

Those who do not agree with this bill hold that it should limit the power of the President, and should define for example, that the operation of aircraft shall not be the function of the Department of Aeronautics except in periods of national emergency and then when directed by the President. The operations of the Navy, War and Post Office Departments and all other departments of the government should be left definitely in the hands of those departments except such times as national emergencies demand otherwise.

The Post Office Department operating the Air Mail Service, is at present one of the most important aeronautic factors in the United States. It can do more at this time to develop aviation and to assist the aeronautic industry in the United States than either the Navy or War Departments, and as it is certain to grow, it will become more influential in the future, and should most assuredly be given an equal position of importance with the War and Navy Departments. It should be granted equal facilities for the operation of the technical section and equal freedom in the work pertaining to design and development of material to meet its special requirements with the War and Navy Departments, and should determine itself, and without the direction of the Department of Aeronautics which types of planes are best suited for its use.

The Board of Control which would be established by the bill, should comprise not three members, one from the War Department, one from the Navy and one representing the Government departments, but should include one representative for the War Department, one for the Navy, one for the Post Office, and one for all other departments. The advantage of this arrangement, which will include a Board of four members and the Director, in which the vote of the Director of the Department of Aeronautics as the fifth member, would be the controlling vote in the case of a tie. It would also give the Post Office Department the necessary voice in aeronautic matters and would prevent the possibility of the appointment of a Treasury official, to represent the very important postal aeronautical operations.

The bill authorizes the transfer of all funds already appropriated for aeronautic purposes to the Department of Aeronautics, but it does not stipulate how these are in turn to be returned to the various departments for expenditures for operations and development work. It stipulates that all

future appropriations are to be disbursed in amount fixed by law or as directed by the President, but it makes no provisions for funds already appropriated.

Following is a copy of the bill introduced by Mr. Morin:

**66TH CONGRESS, 2ND SESSION—H. R. 11206
IN THE HOUSE OF REPRESENTATIVES**

Mr. Morin introduced the following bill, which was referred to the Committee on Military Affairs and ordered to be printed.

To create a Department of Aeronautics, defining the powers and duties of the director thereof, providing for the development, production, operation, and maintenance of aircraft, and providing for the development of civil and commercial aviation.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That there shall be at the seat of government a department separate and distinct from the executive departments, to be known as the Department of Aeronautics, and a Director of Aeronautics, who shall be the head thereof, and who shall report direct to the President, who shall be appointed by the President, by and with the advice and consent of the Senate, who shall receive a salary of \$12,000 per annum, and whose term and tenure of office shall be like that of the heads of the executive departments of the Government, and section 158 of the Revised Statutes is hereby amended to include such department, and the provisions of title 4 of the Revised Statutes, including all amendments thereto, be, and are hereby, made applicable to said department.

The said director shall cause a seal of office to be made for the said Department of Aeronautics of such device as the President shall approve, and judicial notice shall be taken of the said seal.

Sec. 2. That there shall be in said department an Assistant Director of Aeronautics, to be appointed by the President, who shall receive a salary of \$8,000 per annum. He shall perform such duties as may be prescribed by the Director of Aeronautics or as may be required by law. There shall also be one assistant and chief clerk, whose salary shall be \$3,500 per annum, and a disbursing clerk, and such other clerical assistants and inventors, inspectors, experts, scientists, and special agents as may be required from time to time and authorized by the Director of Aeronautics. Until such time as Congress may enact laws creating an Auditor for the Department of Aeronautics, the Auditor for the War Department shall receive and examine all accounts for disbursement of funds appropriated for or coming within the control of the Department of Aeronautics and shall certify the balances arising thereon to the Division of Bookkeeping and Accounting of the Treasury Department and forthwith send a copy of each such certificate to the Director of Aeronautics.

NATIONAL DEFENSE

Sec. 3. That for the national defense, for the more effective and economical administration of the interests of the United States in the development, production, operation, and maintenance of aircraft and all that pertains thereto, and for the more effective exercise and more efficient administration by the President of his powers as commander in chief of the land and naval forces, the President is hereby authorized to transfer to the Department of Aeronautics, any or all of the functions, powers, and duties prescribed by law for any executive or administrative commission, bureau, agency, or department in so far as said functions, powers, and duties include, depend upon, or are served by the development, production, operation, and maintenance of aircraft. That for the purpose of carrying out the provisions of this Act the President is authorized to transfer to the Department of Aeronautics, any or all funds appropriated to the several executive departments or agencies for the development, production, operation, and maintenance of aircraft, or for purposes connected therewith: *Provided*, That any moneys heretofore and hereafter appropriated for use by any executive or administrative department, commission, bureau, or agency shall be expended only for the purpose for which appropriated. For the purpose of carrying into effect the provisions of this Act, the President is authorized to utilize such established facilities and organization of any or all of the executive or administrative departments, commissions, bureaus, or agencies of the Government as he may deem necessary.

Sec. 4. That it shall be the province, duty, and responsibility of the Director of Aeronautics to control all matters pertaining to aerial traffic and navigation and to prescribe, promulgate, and enforce such rules and regulations therefor as in his judgment may be necessary for the national welfare and for the protection of the lives and property of citizens of

the United States, or as may be prescribed or authorized by law from time to time: *Provided*, That the violation of any of the orders or regulations duly made and promulgated pursuant to this authority shall constitute a misdemeanor and be punishable by a fine not exceeding \$1,000 and imprisonment for a term not exceeding one year or both.

That the Director of Aeronautics shall prepare and submit to Congress, estimates of funds, to meet the requirements of all departments of the Government for the development, production, operation, and maintenance of aircraft, aircraft material, and accessories, including fields, shops, aerodromes, and all other facilities connected therewith. All appropriations made for said purposes shall be controlled by the Director of Aeronautics who shall disburse the same or make allotments therefrom to the several executive departments or agencies in amounts fixed by law or as directed by the President.

DEVELOPMENT WORK

That the Department of Aeronautics shall control the procurement of all aircraft, aircraft material, accessories, flying fields, shops, aerodromes, and all other facilities connected therewith, and shall control the assignment and reassignment thereof, including such as are now on hand, to meet the military, civil, and commercial interests of the Government.

That the Department of Aeronautics shall conduct all development work pertaining to aeronautics, except such as pertains solely to the military and naval forces: *Provided*, That the War and Navy Departments shall each determine what types of material of all classes shall be supplied for their respective use: *Provided further*, That the Department of Aeronautics shall furnish the War Department and the Navy Department all necessary facilities for the operation by each of its respective technical sections, the purpose of which shall be to insure to each of such departments the greatest freedom in the design and development of matériel to meet its special requirements.

That the Director of Aeronautics shall be charged with the duty of examining all money accounts covering disbursement of funds appropriated for or transferred to the Department of Aeronautics, with the examination of all property accounts covering all aeronautical property held within the Department of Aeronautics or any other department, and shall have power to prescribe, institute, and enforce such system of money and property accountability as in his judgment will best safeguard the interests of the United States.

It shall be the duty of the Director of Aeronautics to so administer the affairs of his office as will best serve the requirements of the national defense, to develop the aircraft and related industries in order that they may best meet these requirements, to further the development of aeronautics for commercial purposes, and in general to foster, develop, and promote all matters pertaining to aeronautics, including the collection and dissemination of information relating thereto.

The operation of aircraft shall not be a function of the Department of Aeronautics except when directed by the President and to the extent prescribed by him.

Sec. 5. That for carrying into effect the functions of the Department of Aeronautics, the President is authorized to assign individuals or units from other departments or agencies to duty under the Director of Aeronautics, and when so serving the Director of Aeronautics shall have the same authority and control over them as is had by the head of the department or agency from which assigned.

For the purpose of coordinating the aeronautical needs of the several departments and agencies in so far as they come within the jurisdiction of the Director of Aeronautics, there shall be in the Department of Aeronautics and reporting directly to the Director of Aeronautics, a board of control, consisting of three members, who shall be appointed by and with the advice and consent of the Senate for a term of office of four years. One member of the board of control shall represent the interests of the War Department and shall be selected from among the officers of the Air Service of the Army, and while serving as a member of the board of control shall have the rank, pay, and allowances of a major general of the Army. One member of the board of control shall represent the interests of the Navy Department and shall be selected from among the officers of the Air Service of the Navy, and while serving as a member of the board of control shall have the rank, pay, and allowances of a rear admiral of the Navy. One member of the board of control, who shall not be an officer of the Army or the Navy, shall represent the Post Office and other departments or agencies of the Government not otherwise represented, and while serving as a member of the board of control shall receive a salary of \$8,000 per annum. The members of the board of control shall have such assistants detailed from the departments which

(Continued on Page 1277)

Why Automobile Editors Are Press Agent Misanthropes

The automobile editor of the Detroit "News" agrees with the views expressed in previous articles in *Automotive Industries*. He tells why much automobile publicity is defective and suggests a remedy which may be easily applied by any publicity agent.

By W. D. Endenburn

WITH the existing shortage of news print paper in the publishing world, curtailment of the lavish use of publicity is due, and there will come a day when only the actual news of the motor car industry will be published. If manufacturers, however, consider publicity in the proper light, they will be able to stave off this threatened situation for many years. Too often, though, they seek only lineage and total columns, rather than representation in the automobile sections by short, snappy, true to fact, well written stories.

When the automobile became more than a mere toy in the industrial world, particularly in America, publishers generally sought and used any item of news or near-news concerning this new unit of transportation. This was because the reading public at large was deeply interested in the "horseless carriage," and star reporters were often assigned to obtain news—or more often mere items—concerning its progress. But this day has passed, and a story must now come up to the newspaper standard if it is to be printed.

In the newspaper world, speaking generally, there are only two kinds of stories, the straight news and the feature or "human interest" type. Very few publicity offerings contain news and the feature stories are often badly written.

Automobile editors become cynics and "press agent misanthropes" after handling publicity for any length of time. We are bombarded with lengthy expositions of a factory executive's opinion, topics of the day, industrial problems, etc. We receive figuratively, tons of mail, consisting in the main of matter pertaining to the excellence of the company's product which bears all the earmarks of being lifted bodily from the catalog. Judging by the amount of minute detailed mechanical descriptive matter and sales talk. Then we receive feature stories, containing the element of "human interest," but drawn out to such an extent that it is lost sight of in the story as prepared; also items concerning the fuel economy or tire economy in the hands of an owner, in which the facts are too often distorted on the side of the product.

BREVITY AND NEWS VALUE ESSENTIAL

The four classifications cover the field generally. There is still another, woefully in the minority now, telling of the product's performance in an official test, whether it be cross country touring, hill climbing, racing or fuel economy.

This latter class is really the reason for publicity having obtained its foothold in the Sunday editions of the metropolitan papers and the small city dailies. Ten years ago, when the mechanism of the motor car was being refined, in the "contest crucible," there were many national events every season, in which the public was deeply interested and which in turn had a far reaching influence on the sales of com-

peting cars. Now very few manufacturers participate in Contest Work. With this source of material eliminated, the publicity manufacturer must earn his salary by compiling his offerings from available material, which consists of the first four classifications.

The average man today is busy and even on Sunday will not pore over lengthy articles. A short story appeals to him and he will read it, because it is short. Seeking to obtain the maximum space, for his employer, the publicity manufacturer turns out stories twice as long as he expects to see in print, because he fears the editor will "chop" and "prune." To make this doubly hard, he besprinkles it with superfluous adjectives and flowery descriptions of inconsequential factors in the story, and uses sentences so involved as to practically demand the re-writing of the story if it is to be used. Consequently, the editor often finds it more convenient to discard the story, than to re-write it.

PHOTOGRAPHS

Publicity as defined by the new Standard dictionary is "the state of being public or open to common knowledge; exposure to the view or knowledge of the public; the opposite to secrecy."

The reader will agree that it is well and properly "tagged" but that "common knowledge" does not result, due chiefly to its extreme wordiness.

Many firms waste money in photographs. Instead of sending out photographs of news value or at least with some animate object to relieve its inanimate monotony, they bombard the newspapers with reproductions of catalog photographs. These have usually been retouched and distorted to make them more impressive than the bare photograph of the model would have been.

Also, there is the "art wise" publicity man who fakes his photographs. In the end he does not succeed, as the editor is usually just as keen on photographs and sees the deception.

The reading public is not hoodwinked by present brands of publicity. Since the newspaper is published for the masses, even the automobile section should contain matter that would make it attractive to everyone, rather than to the trade alone.

The majority of the publicity men are former newspapermen. Is it not a sad commentary on their training that the individual so quickly loses his news sense and sense of proportion, after starting on automobile publicity?

Very often, however, the individual is not entirely to blame for his product. In almost every factory the sales head must pass on the story. He seldom has had the experience to qualify him as a competent judge of a story's worth. He is primarily a salesman; and this accounts for the preponderance of sales talk and lack of news.

Newspaper publishers are much to blame for the present situation. They have established a bad precedent by using almost anything submitted, if an advertisement accompanied it, or if the publication was "scheduled" for the particular firm advertising. Publicity is often looked upon by the manufacturer or dealer as a means of obtaining personal notoriety and impressing the competitor with the individual's importance. Basically it is desired as an adjunct to the sales campaign, but "false gods" destroy its worth and it is more often ridiculous in its effort to put the individual upon a pedestal.

It is not well to criticize without suggesting a remedy. My own opinion is that if the publicity manufacturer would boil down his stories, stick to facts, avoid needless and apparent exaggerations, and submit short, tersely told items, the automobile sections would be more interesting, more widely read and at the same time bring better results.

Telling actual news and feature stories in the least number of words and use of more judgment in sending out photographs, also sticking to the unvarnished truth, will make automobile publicity more acceptable and much more widely read.

Several firms, I have in mind two tire companies, are now sending out short feature stories, along with their lengthy contributions. Reading papers from all over the United States and Canada, one is astonished by the wide use of these short stories, to the exclusion of the longer articles. Publicity men generally could profit by their example.

Results should be deduced from the number of articles used annually rather than on a basis of total space obtained. Publicity items, except in extraordinary instances, should never exceed 300 words.

The automobile section should be attractive to owners, non-owners, and the tradesmen, by combining general news of the industry, publicity and items of interest to the man who owns or will buy a car. This would include matter pertaining to the care of motor cars and their operation, activities of automobile and allied organizations, touring news and unusual photographs, where automobiles are factors.

Such a section would interest many readers who now discard the publicity jammed pages and would better obtain the results the manufacturer desires, when he maintains a publicity organization in his factory. To attain such an ideal automobile section will require the combined efforts of the editor and the publicity man.

An Aeronautic Department

(Continued from Page 1274)

they represent as may from time to time be found necessary and as may be directed by the President: *Provided*, That one or more of said assistants from each department represented on the board of control may, by order of the President, be empowered to act for their respective principals as members of the board of control: *Provided*, That no officer of the Army or Navy shall be eligible for appointment or reappointment as a member of the board of control unless he shall have had at least two years aeronautical duty with the Army or Navy, respectively, in the three years just prior to such appointment or reappointment.

For the purpose of computing aeronautical duty as required by this provision the duration of any aeronautical duty performed in the Army or Navy since April 6, 1917, and prior to the date of the passage of this Act shall be doubled: *Provided, further*, That the eligibility of an officer of the Army or Navy for appointment to the board of control shall not be otherwise restricted by existing law governing the eligibility of Army or Navy officers for detached service. It shall be the duty of the members of the board of control to keep themselves informed on all matters coming within the province of the Department of Aeronautics which pertain to or affect the departments or agencies which they represent. It shall be the duty of the board of control to recommend to the Director of Aeronautics such action on all matters coming within the province of the Director of Aeronautics as affect, directly or indi-

rectly, the interests represented by the members thereof, with a view to securing action which will best serve the interests of the United States. Each member of the board of control will submit to the Director of Aeronautics annually or when relieved from duty as member thereof a report embodying his views for the better fulfillment of the functions of the Department of Aeronautics with special reference to the interests which he represents. These reports will be forwarded by the Director of Aeronautics to Congress not later than the 15th day of December each year.

Sec. 6. That for the purposes of this Act there shall be, and is hereby, appropriated, out of any money in the Treasury not otherwise appropriated, the sum of \$100,000.

Sec. 7. That the Director of Aeronautics shall annually at the close of each fiscal year make a report in writing to Congress giving an account of all moneys received and disbursed by him and his department and describing the progress made in the development of military, civil, and commercial aeronautics. He shall also, from time to time, make such special investigations and reports as may be required by the President or by Congress or which he himself may deem necessary.

Sec. 8. That this Act shall take effect from and after the date of its passage, and all Acts or parts of Acts contrary to the provisions of this Act or inconsistent therewith be, and the same are hereby, repealed.

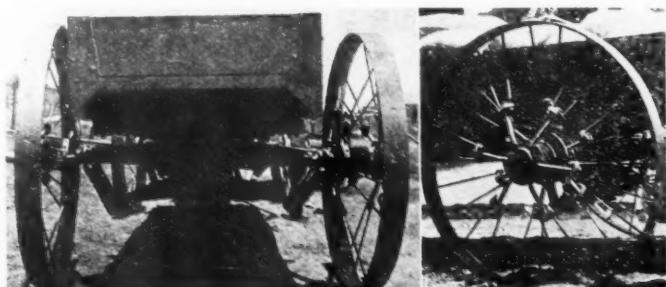
Trailer for Long Distance Hauling in Africa

AFRICAN railroads make free use of motor trucks and trailers to ease their transportation troubles. Bad roads are a reality in South Africa and the rubber tire trailer has not met the situation. The photographs are of a trailer built to the order of H. A. Stockman of Johannesburg for long distance hauling with a truck as the motive power. The construction of the springs and wheel is interesting. Each truck

pulls two trailers loaded with four tons each. These trailers were first designed for hauling ore from mines in the Belgian Congo.



This trailer was built especially for long hauling in South Africa





The FORUM



Remedy for Crankcase Dilution

Editor AUTOMOTIVE INDUSTRIES:

The editorial on "A Suggested Remedy for Crankcase Dilution" in AUTOMOTIVE INDUSTRIES for October 23, interests me particularly, because the matter of crankcase dilution is one which has attracted a great deal of my attention. The remedy you propose, that of drawing the carburetor air supply from the crankcase, is one which seems to me very attractive, but concerning which there are certain problems to be solved before the matter becomes practical.

Increasing in importance in the order named, the motor car, truck, and tractor must be fitted with an uncommonly efficient air cleaner before we will be justified in directing the entire air supply of the engine through the crankcase. If on the other hand, the air cleaner happens to be of the wet type, we shall run into another difficulty, due to the entrained water carried by the air stream and for which the crankcase will act as a settling chamber. Then, too, unless the theory that the crankcase is filled with a mist of oil which lubricates the cylinder walls and other bearing surfaces not otherwise provided for is exploded as a myth we shall find that this oil mist will be drawn out of the crankcase and into the cylinders of the engine at a rate which will be rather expensive and which may possibly complicate the matter of keeping spark plugs and combustion space walls reasonably clean. To be sure, a great deal may be done to minimize this oil loss by withdrawing the air from the less turbulent regions of the upper part of the crankcase and by the use of centrifugal separators with ample precipitation surface.

If properly worked out, the suggested arrangement would have an important incidental advantage in that it would do away with the usual crankcase breather. Practical men for some time have recognized the crankcase breather as being largely responsible for abnormal wear of the bearings inside the crankcase and it is with much satisfaction that they note some of the latest tractor motors eliminating the usual breather opening.

Another angle of the matter is to be found in the effect of the entrained oil on the preignition problem. It is just possible that the oil mist carried into the cylinders, particularly when the engine is working hard, will obviate the necessity for moistening the ingoing mixture with water, so that one of the chief reasons for using the wet type of air cleaner may be eliminated.

If the insiders were to tell the whole truth, they probably would admit that air cleaners for passenger cars are needed though in somewhat less degree than in the case of trucks and tractors. The matter was neatly expressed by an observant repairman:

"If there is no grit drawn into the cylinders of an automobile engine along with the air, what is it that polishes the inside of the manifold at the bends?"

W. B. JONES.

Air Weight

I have just perused copies of Automotive Industries, dated June 12 and June 19, 1919, containing an article by Don T. Hastings entitled "Air Weight and Volume Measurement." This article attracted my attention because of the close relationship that the subject bears to the work in which I have recently been engaged. With all due respect to the author of the article, I would like to correct some of the mistaken ideas that he has inferred or expressed.

With regard to the accuracy of a venturi meter, it is commonly, but erroneously believed that the coefficients or correction factors are only slightly below unity, and more or less constant in value under varying conditions. Recent tests have proven, however, that the coefficients may vary several per cent under normal conditions, and that they are seldom higher than 0.98 except for very large meters. It would seem, therefore, that accurate results cannot be secured from a venturi meter unless its coefficients under different heads have been determined by careful calibration.

Referring to Mr. Hastings' arrangement for checking the accuracy of the meters by comparing the sum of the quantities of air passing through the four smallest meters with the quantity indicated when the same amount of air passed through the largest meter, this is really no check at all. It will be found upon comparison of the throat areas that the aggregate for the four smallest meters is approximately equal to the throat area of the largest meter. It is conceivable, then, that the flow might be proportioned through the various meters so that the velocity would be practically the same, i. e., the heads indicated by the various manometers might be about equal. Neglecting, for the time being, the effect of the size of meter on the coefficient, and taking data from the curves given on page 1280 of the article under discussion, assume an arbitrary coefficient of 0.90 for the case where the pressure difference was 1.6 inches of water and see what happens:

No. of Meter	Diam. in. 1	Throat Area sq. in.	Meter Indication lb./min.	True Weight on basis of Coeff. = 0.90
1		.7854	4.80	4.32
2	1/4	.0491	2.8	2.52
3	5/16	.1104	1.1	0.99
4	1/2	.1963	0.6	0.54
5	9/16	.4418	0.26	0.23
Sum of 2, 3, 4, 5		.7976	4.76	4.28
Difference			0.04	0.04
(less than 1 per cent in both cases)				

Note the difference between the corrected weight indicated by the largest meter and the sum of the corrected weights indicated by the four smallest meters is less than 1 per cent when a coefficient of 0.90 is used as well as when a coefficient of 1.00 is applied. Thus, the fallacy of attempting to check the accuracy of the meters in this way becomes evident. Furthermore, without carefully proportioning the relative amounts of air passing through the four parallel meters, it is quite probable that the coefficients would be widely different. It is generally true that the coefficients for venturi meters increase with the velocity and with the driving pressure, and also increase with the size of the meter, but the coefficients for meters of usual proportions are always less than 1.00 unless abnormal conditions prevail.

While attempting to develop a new method for calibrating air metering devices, the possibility of checking the accuracy of the method by "multiple comparison" occurred to me. Accordingly, three venturi meters of the same size were procured and set up in Y formation for a series of tests in which varying quantities of air passing through the first meter were divided at a Y connection and distributed in different relative proportions to the other two meters. It was assumed that the coefficients or calibration curves of meters exactly alike would be identical, therefore, only one of the meters was calibrated prior to the multiple comparison tests. Applying the coefficients thus obtained to data procured in the multiple comparison tests, it was found that the computed weight of air passing through the first meter checked the sum of the computed weights indicated by the other two meters very closely. There was some difficulty at first in procuring satisfactory results, however, because the three meters would not read exactly alike under the same conditions. This discrepancy was probably due to slight differences in size of throat or condition of interior surface of casting. It was found by comparison with the first meter that the other two read two-thirds of one per cent and three-quarters of one per cent higher, respectively.

The graphical method of solution presented by Mr. Hastings is very interesting, but not easy to grasp. His main objection to the use of computations, namely, that the process is slow and laborious due to the complexity of the venturi meter formula, does not really hold true if one makes use of the modified formula presented by Professor G. B. Upton.* This formula is as follows:

$$W = C_1 \sqrt{\frac{P_1 \Delta P}{T}} \left(1 - C_2 \frac{\Delta P}{P_1} + C_3 \left(\frac{\Delta P}{P_1} \right)^2 \right)$$

in which W = weight in pounds per second,

P_1 = absolute pressure at entrance, lb. per sq. ft.,

T_1 = absolute temperature, Fahr.,

ΔP = venturi head, or drop in pressure from entrance to throat, lb. per sq. ft.,

C_1 , C_2 and C_3 = constants for any particular meter and gas.

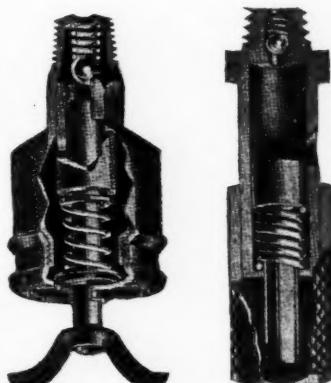
After the constants have been established for a given meter, the formula can be solved in a few seconds by

slide rule calculations, which is probably a quicker and more accurate method of solution than the graphical method.

Now, with regard to desirable mixture proportions in throttle-controlled engines operating on liquid fuel, Mr. Hastings conveys the impression that the strength of the mixture should not vary with the throttle opening, excepting that at idling speed the mixture should be slightly richer because of greater dilution of the incoming mixture by burned gases remaining in the cylinder. Granting that richer mixtures are desirable or even necessary when the percentage of dilution is greater, is it not true that the percentage of dilution varies with the throttle opening over the entire range of power from idling to full load? It would seem advisable, then, to vary the strength of the mixture throughout the entire load range in order to conform to the variations in percentage of dilution.

Another factor of great importance must also be taken into consideration, namely, variations in compression due to throttling. At full load, with wide-open throttle, the compression pressure is maximum, while at low loads, with throttle nearly closed, the compression pressure is very much below maximum. It is a fact, well established by theoretical and experimental evidence, that leaner mixtures can be used advantageously with higher compressions, while richer mixtures are required for lower compressions. Ignition and combustion are facilitated by high compression, because of diminished dilution, increased temperature of the mixture and closer proximity of the combining molecules. Upon what grounds, then, can it be claimed that the mixture for a throttle-controlled engine should be proportioned the same over the entire load range?

L. A. WILSON,
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THE sectional drawings accompanying this description illustrates two forms of oil cups manufactured by the Madison - Kipp Corp., Madison, Wis. These differ from ordinary oil cups in that the oil is forced into the bearing under spring pressure. One of the oil cups has a reservoir of considerable capacity, and its plunger is provided with a grip which can be conveniently taken hold of by the hand. A coiled spring within the reservoir forces the plunger against the seat. As the plunger is withdrawn the space below it fills with oil from the cup, and when the plunger is then released the spring will press it back and force the oil through a small valve into the bearing.

The small oil cup, which is intended mainly for spring bolts, is similar in action, except that it has no large oil reservoir. When the plunger is withdrawn, by gripping the cover of the oiler, an opening in the side wall is uncovered, through which oil can be squirted in by means of a squirt can, and when the cover is then released, this oil will be forced into the bearing by means of the spring behind the plunger.

*Sibley Journal of Engineering, Nov. and Dec., 1914.

Standardized Working Day is an Unsatisfactory Solution

That the limitation of hours of labor by general regulation does not solve the problem of determining the proper length for working periods is clearly shown by Mr. Tipper. The psychological as well as the physical conditions of production must be considered in each case to obtain a satisfactory result.

By Harry Tipper

ONE of the subjects which in its discussion exhibits great confusion of thought in connection with the labor problem, is the standardized day and the number of hours which it should comprise. In some industries, the work is still being operated on a ten-hour basis, and in some industries the eight-hour day is beginning to make some headway. Again the forty-four-hour week has been included in the demands of the labor bodies for some time, and in the future program of a number of these bodies the six-hour day figures. Lord Leverhulme, the largest soap manufacturer in the world, himself, has written a good deal advocating the six-hour day.

In all these discussions, the purpose of limiting the number of hours which should be spent upon a certain occupation has not been fully determined, and the premises upon which these discussions occur are assumed in many cases or do not respect the real object of the limitation.

The manufacturer approaches this question of hours of labor upon the assumption that the shortening of the hours will automatically cut the production by the same proportion. The labor unions desire to secure for their members the shorter working day, but without any decrease in the pay. The government regulations are considering this matter from the standpoint of the maximum allowance which can be made without injuring the health of the community or nation, and the demands of the worker individually are governed by an entirely different set of psychological considerations.

The relation between hours of labor and cost of production is an arbitrary one as it is considered by the employer of labor, the management and the worker.

The number of hours which the staff of workers put in does undoubtedly bear a relation to the amount of work which they do; but without a knowledge of the psychological processes which govern the worker's action, the condition of the particular work, the living conditions of the worker and other factors which enter into the matter this relation is a mere arbitrary assumption and not a scientific valuation.

The difference in hourly production between the workers of the Bullard Machine Tool Company's plant and workers in corresponding operations in the city of Bridgeport is 170% of

the average quantity, produced per hour by the general labor body of that type in that city. This means that the skilled worker in the Bullard Machine Tool Company's plant is actually producing per hour two and one-half times that which is being produced by men in corresponding occupations in other concerns in that same locality. On that basis, if a Bullard Machine Department were operating eight hours per day, a worker in a department of some other factory in Bridgeport conducting the same types of operation would be required to work twenty hours per day at his present speed in order to equal the Bullard production. It is obvious that the relation between the number of hours and the actual production per man is not proportionate and that other factors have more influence upon the production than the increase or reduction of the number of hours.

In one department of an automotive factory in Ohio during the war, the production of skilled operators was two times the average production of operators in the general industry, which means eight hours of work by that department per day produced as much as sixteen hours of work would have produced in the average plant. This question of hours is closely allied with the question of change or rotation of work. The physical and mental fatigue accumulates much more rapidly where the operations are limited and highly repetitive.

So long as the customary method of organization demands that one man be kept on one piece of work, the demand for shorter hours in respect of that work will be incessant, because of the fatigue which accompanies operations of this limited mental and physical character. Similarly there are many operations in connection with industry which are very disagreeable in themselves and in respect to which the most careful attention, to light, to air, sanitation and comfort will not entirely relieve the disagreeable necessities from the work. Under such conditions, also, the demand for shorter hours is likely to be incessant because the very character of the work provides an incentive to escape from it more frequently. In other cases of industry, the operation involves a physical exertion which on account of its regularity and amount brings about a more rapid deterioration of the bodily health, so that in some of these cases the average life of the worker in his usefulness to industry is materially shortened. In such cases the number of

hours in the day demand special consideration, and increasing study of the matter will develop the necessities.

All these things indicate, of course, that

the question of hours even where it is viewed from the standpoint of production only, is not advanced by attempts to standardize it to a general dead level. The psychological conditions, the character of the physical necessities and the surrounding of the work suggest the advisability of a variation in the actual hours of labor and a variation in the frequency of relaxation periods for the best production results.

Of course, the social necessities of community life, demand that some orderly arrangements of hours and labor be observed so that the relaxation period can be spent in the best interest of the worker, his family and his community necessities. But the present method of deciding upon such orderly arrangement is a tradition which has been the subject of hardly any analytical study and which is not entirely suitable to the necessities of modern social organization.

Lord Leverhulme in his book on six-hour day and other questions, brings in the novel argument that the six-hour day should be observed in industry, in order to provide the worker with sufficient time to improve himself to the point of development that should lie before him. He also, of course, insists upon keeping the machine busy by multiplying the number of shifts so that the utmost can be secured out of the equipment and machinery with which the production is secured. There is no doubt that in large cities where the worker must travel longer distances to and from his work a number of hours which can be spent in his occupancy must be somewhat shorter if the social organization is to progress as rapidly as it should. The time actually employed in the work is the time which the manufacturer figures and he has not as a rule studied the conditions of living which affect the attitude of the worker on this point. The worker himself must as far as his other necessities are concerned, measure his day from the time that he leaves his home for his work until the time he is able to reach it again, because that time is taken away from his leisure social existence and the performance of his other social duties.

The character of education which is provided for the worker in the school system and its ability to give him the fundamentals for self development, must be taken into consideration, in determining the effect on the social organization of limiting the maximum hours of labor which should be asked from the general standpoint.

The limitation of hours of labor by general regulation does not solve the question. It is up to the manufacturer to find out what is the length of a working period which will provide the greatest production with the least accumulated fatigue and with the greatest incentive for continued operation.

This applies not only to the total number of hours of work, but to the length of time between the rest periods.

In some of the factories where women workers are employed

to a very large extent upon highly repetitive work, it has been found advisable, from the standpoint of production, to provide, a short rest period at the end of two or two and one-half hours, as the curve of production dropped very rapidly in the third and particularly the fourth hour of the ordinary day. The connection between the number of hours which can be worked at maximum production and the change of work is very obvious. The monotonous work which is very limited in its physical and mental requirements, produces fatigue which carries over to some extent to the following day, and this fatigue accumulates, until a minimum pace has been set at which point the individual protection to the nerves and muscles is secured. Change of work in jobs, so that they are operated in cycles will relieve this accumulated fatigue and enable the worker to proceed on a basis more nearly the maximum in continued operation. The two studies should go together, and it is upon points like this, that the experience of the worker could be harnessed to much advantage in the development of more effective organization.

I believe the workers' councils of all kinds, where they are properly directed and where they have established a spirit of confidence, can be of great service to the executives of industrial establishments, in illuminating the worker's relations to his job and the effect of that relation upon his production capacity.

Of course, this cannot be accomplished through such machinery unless the workers' councils have been operating for a sufficient length of time to provide a common basis of understanding of organization necessities, and it is probable that educational work on production elements, both physical and psychological, would be necessary in order to bring the machinery of organization up to this point. It is obvious, however, that the management knows little of the factors which enter into production and particularly those factors in respect to the psychological relation to the work which after all, have the greatest economical effect upon the cost of production. These factors, however, must be understood if the industrial organization is to continue to provide an improvement in the social and economic condition of the worker and, at the same time, produce without proportionally adding to the cost of the product.

For these studies, it will, of course, be necessary to go outside of the engineering text books and the books upon scientific management. Observation will accomplish a great deal, providing that the observation is keen enough not to be covered by previous prejudices or limited by any special habit of mind. Observation of the workers in the individual plant, a careful consideration of their casual conversation, their subconscious reactions to a suggestion and their general attitude together with some study of the general psychology of the worker will lead an open minded and alert manager to a good many fundamental facts which are related to his production necessities and these undoubtedly are the first necessary steps in the consideration of production activity in its relation to the hours of labor and the actual periods of work.

Activities of the Institution of Automobile Engineers

THE annual program of the Institution of Automobile Engineers (of Great Britain) has reached this country. There will be six meetings of the Institution at London, one each month, until May. In addition, there will be a meeting at Birmingham on January 29 and one at Coventry in May, while five meetings will be held by the Scottish Centre at Glasgow. The President's address has already been read in London, Birmingham and Glasgow.

In addition to these papers, Dr. W. H. Hatfield will read a paper on The Steels Suitable for the Various Parts of an Automobile, having in mind the standard automobile steels already published by the British Engineering Standard Association; Maj. B. H. Thomas will read a paper on the Practical Application of Electrical Deposition for Motor Vehicle Repair-work, and Lieut. Col. T. B. Browne will read a paper on The Design of Motor Vehicles as Affected by War Conditions.

Following is a list of papers to be presented to the Grad-

uates Section, London Branch: "The Effect of Detail Design on the Cost of Production," H. B. Benny; debate on "Worm vs. Bevel Drive;" lecture on "Steam Vehicles," Thos. Clarkson; Steering Gears, F. R. Cowell; Magnetics, C. A. Chappell; The Use of Benzol, W. D. Pile; The Chemical and Physical Properties of Iron and Steel, W. W. Denbow.

The following papers will be read before the Graduates Section, Coventry Branch, during the session: Automatic Manufacturing Machines, R. V. Newton; Elimination of Noise on Motor Vehicles, H. Norris; Discussion on Olympia 1919, Epicyclic Gearing in Automobile Practice, D. L. Prior; Ford Methods, A. Tilt; Road Illumination for Motor Vehicles, L. Griffiths; some W. D. Vehicles under abnormal conditions, C. J. Fisher; Battery vs. Magneto Ignition, A. Verry; A Critical Survey of Detail in Current Engine Design, F. Veals; Design of Gearbox for Commercial Vehicles, E. Caudwell; Non-rigid Airships, B. W. Barlow; Valve Operating Mechanisms, Their Effect in Timing, C. P. Wedmore.

AUTOMOTIVE INDUSTRIES

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British Civil Aviation

In a report covering the first 6 months of civil aviation in England, Col. F. H. Sykes says: "It may be questioned whether civil aviation in England is to be regarded as one of those industries which is unable to stand on its own feet, and is yet so essential to the national welfare that it must be kept alive at all costs. If this question is answered in the affirmative, there appear to be three methods of assisting it:—

(1) By means of direct Government subsidies—it is in this way that France has decided to act, and 18,000,000 francs have already been earmarked for this purpose.

(2) By recognizing that *at the beginning* the British aircraft industry cannot stand on its own feet, and that to ensure its existence, although foreign to usual British practice, some form of *direct* Government assistance, probably in the shape of a grant to approved aerial transport companies for mileage and weight carried, is a necessity.

(3) By following the principle usually accepted in this country, that if an industry is to survive it must stand as nearly as possible by itself, and that a policy of "doles" is unsound. In this case the assistance given would take the indirect form of the provision of certain "key" aerodromes and shed accommodation at home and on the Empire routes, and the collation and issue of information, including meteorological data, and the provision of communications.

The problem is how best to tide over the difficult transition period through which we are passing. Adhesion to the British principle of independent private enterprise will undoubtedly be right eventually, but if a limited industry is to be maintained—as it must be to meet the requirements of the Royal Air Force—it is for consideration whether it will not be necessary to adopt a combination of (2) and (3) above.

Front Brakes for Motor Trucks

A WRITER in *Camion et Tracteur*, suggests that it would be advantageous to mount front brakes on commercial vehicles. He says that in motor trucks, when empty, the weight is usually about equally divided between front and rear axles, and if brakes were fitted to the front wheels they would double the braking power. Another fact which makes front brakes very desirable, is that in descending a steep hill some of the weight is transferred from the rear to the front axle. In motor trucks the center of gravity is generally much higher than in touring cars, and this tends to cause a greater shifting of weight in descending a grade. In conclusion, it is pointed out that the firm of Isotta-Fraschini has brought out a small truck equipped with brakes on all four wheels.

Car Sales in India

THE French consul writes from Calcutta that since the end of the war business in India has picked up considerably. The Americans, and particularly the Ford Co., are making a strong effort to capture the market. The price at which the Ford is sold, 2,750 rupees, defies all competition. There is a large service building with a full stock of repair parts in Calcutta, and the Ford Co. is now erecting a sales building there also. On the other hand, the Indian Government plans to place on the market 20,000 automobiles which were used by the army in Mesopotamia. This will probably tend to depress prices and retard importation. According to an apparently well founded rumor the Indian Government intends to levy a duty of 25 per cent on all automobiles of foreign manufacture.

The Death of M. de la Meurthe

FROM Paris comes the announcement of the death of M. Deutsch de la Meurthe, president of the Aero Club of France. Duetsch was a wealthy petroleum refiner, who did much for the development of motoring and other sports in France by the donation of liberal prizes.

Greetings!

THE date of this issue suggests many things to all persons. Most persons admit the value of a sentimental season to break the monotony of business routine and only a few of them have been converted to this idea, as was old Scrooge. It is born with most of us. The return of the date, to most of us, suggests the days when we were younger.

To the automotive industry, the day and the season seem to have a peculiar significance. In addition to the rewards of a year's work almost done, there is always the feeling that the season's work is almost past and the anticipation that this season's work will rank well in comparison with the work of others when it is put on display early in the new year. There also is the anticipation of the reunion days to come when the hosts gather for the shows, the scientific meetings, the sales meetings and the general good time and for the planning for the busy production and selling season to come.

This year, especially, should the automotive industry have a good Christmas, for never did the coming year hold for an industry a better prospect than it does at this season.

This year the Automotive Industries' staff feels peculiarly akin to the workers in the industry. For during the recent months we have been working under conditions that are akin to those of the designers and construction engineers. We have had many troubles of our own in getting out our magazine and at time we have had to grapple with problems that had no precedent. But we have at all times been hopeful and we have had a confidence in our readers and ourselves that could not be shaken.

We are looking forward to the show season as the period when we will have all of our work of the last months before our public and we will be ready to go into the new season with our specifications sheet filled in.

The conditions are such, at this writing, that we do not know exactly when this message will be read, so we cannot properly phrase the tense. But we are going to say it:

We wish to all members of the industry, and all fellowmen, a happy Christmas and a properous New Year.

If you read this a bit late, remember that we held the sentiment long in advance and that we were confident that this sentiment was returned, just as much as though we had heard you say it.

We are going a step further, and say that we sincerely hope that the season just past has brought each and every reader just a bit closer in touch with his associates, and that our best hope for the year that is before us all is that the relations of employer and employee may become more and more on the Christmas basis, so that each may be fearless and confident in dealing with the other.

Factories Face Closing Unless Steel Supply is Amalgamated

*Reserve Stocks Which Maintained Industry on
Complete Production During Strikes Are
Now Depleted and New Supply Is
Three Months Behind*

DETROIT, Dec. 24—No stone will be left unturned in the automobile plants in the effort to locate every scrap of steel in the yards. It is no exaggeration to say the majority of factories in the Detroit district are face to face with the critical situation which two months ago was predicted for the beginning of 1920 when the reserve stocks would have been exhausted.

The reserve stocks are exhausted or nearly so. No attempt is made to deny that fact. The new year rapidly is approaching and the outlook is troubling many of the executives of automobile factories which lack long-time business relations with steel manufacturers or strong friends at court to push their appeals.

While it would be hardly fair to assume wilful misstatement of fact with regard to conditions at the various plants, the optimistic statements dealt out by a majority of officials are traceable to over-zealousness or unwillingness to acknowledge a lack of foresight that permitted present conditions to arise.

Certain it is that many of the manufacturers actually are operating with the constant fear that the next day may bring conditions that will interrupt production schedules if not actually compelling a shut-down for lack of material. The purchasing agent of one of the largest automobile factories in Detroit, in a statement to AUTOMOTIVE INDUSTRIES, declared it was a hand-to-mouth existence with many manufacturers, with the odds greatly in favor of their being forced to suspend operations temporarily.

CRITICAL POINT REACHED

"The man without protection of an order placed at least six months ago may be able to scratch through, but it will be a mighty close shave," said J. H. Main, purchasing agent of the Cadillac Motor Car Co. "The situation today with all reserve stocks depleted is infinitely worse than at any time since the strike began in September. As far as our own plant is concerned we still are in fairly good shape and long ago protected ourselves with advance orders."

C. F. Ritchie, purchasing agent of the Detroit Pressed Steel Co., said there was a serious shortage in the steel market and that it would continue critical throughout the first quarter of 1920 at least. While the mills are working with the full labor complement, he said there was lacking the productive effort to insure 100 per cent output.

Announcement of the United States Steel Corp. prices for 1920 are awaited eagerly by industry generally. Whispers among the independents, who await the corporation's announcement before adjusting prices, fix the increase at from 35 to 40 cents. Some automobile manufacturers predict a much higher raise. Ritchie, whose views on steel are looked upon as most nearly authoritative by Detroit interests, would make no prediction as to the new price, but declared it his belief it would not be under 50 cents.

Ritchie said his company was well protected, but admitted that conditions in many local plants were grave and expressed inability to mark out a course that might be pursued to enable them to weather the rough journey during the next few months.

PRODUCTION LOSS 20 PER CENT

Conservative estimates place the actual loss in the steel output for 1919 as a result of the strike at 20 per cent. That figure however is too low according to a number of automobile manufacturers who responded to letters sent out by F. J. Haynes, purchasing agent for Dodge Brothers. Although his company is well supplied with steel and wields a strong influence with manufacturers, by reason of the enormous consumption of the Dodge Brothers plant, Haynes wrote to eight manufacturers asking their views with regard to the conditions of the steel industry with relation to the effect on automobile manufacturing.

The reply in every instance, according to Haynes, fixed the actual loss at 25 per cent of the 1919 business.

"That means," said Haynes, "simply that the steel manufacturer goes into the year 1920 with a large per cent of the business for the last quarter of 1919 on his books. Naturally his first effort will be to clean up his back orders and by the time he has completed the task he will find himself approaching the second quarter of 1920 with orders for the first of the new year, in a great measure unfilled.

"Straining every energy, the steel manufacturers will find it impossible, I believe, to catch up with the procession and put back into our yards the pre-strike reserve stocks for a year at least. In many instances automobile manufacturers had the foresight to fortify themselves against the strike which to me had appeared inevitable for months before the storm broke. They laid in surplus stocks

that have tided them over without interruption and in some cases they have divided with the less fortunate brother who from lack of foresight or some other reason had failed to build up his reserve. Those cases, however, were rare and concerned chiefly the effort of manufacturers to help the parts builders to keep going as a matter of self preservation."

PREMIUM OFFERS GO BEGGING

Some idea of the gravity of the situation is revealed in the efforts of some automobile manufacturers to get steel regardless of the price, and it is a well-known fact that some of them have relied upon the bonus or premium plan to get material. So eager have they been to get steel at all hazards they have offered premiums as high as \$20 a ton for sheets, the aggregate in premiums alone, according to an automobile manufacturer, being sufficient to make the annual income of the steel industry of Carnegie's day appear small.

As a rule the larger steel manufacturers are side-stepping this class of business, leaving it to the smaller mills, while they devote their energies to overcoming the production deficit and at the same time caring for established accounts in order that their good customers may continue business without interruptions. Even the smaller mills are hesitating to grab at the premium bait, for they, too, are under obligations to old customers, whose demands will keep them busy.

The apparently prevalent and at the same time absurd idea that a resumption of manufacture would find steel mills in position to take care of all demands resulted in the steel manufacturers being literally swamped with orders for finished iron and steel of all kinds which they were not in position to take care of. So anxious have been purchasers that in a number of cases steel consignments varying up to car-load lots have been shipped by express.

"The fellow that had failed to fill his yard and nurse his stock found himself compelled to resort to such measures in his extremity," Haynes continued. "And he is a long way from being out of the woods now. The coming year is going to be particularly hard for any firm that is not well protected at the source on the basis of long-standing business relations or which is not well represented by influential friends in the industry.

BODY BUILDING STEEL SHORT

"While there is a shortage of all kinds of steel, the sheet situation is felt most keenly. But where the rub comes in is in the highly-finished sheet steel for body building. With black sheets 100 per cent good and the highly-finished product running to three grades, there naturally will be a tendency with some manufacturers to content themselves with the black production, eliminating the element of chance in the highly-finished product.

"An added feature that must not be overlooked is the fact that the mills are not up to 100 per cent production and will not be for a long time. The individual productive capacity is not aroused as before the war."

FORD EMPLOYEES GET \$10,000,000 BONUS

Are Also Granted Right to Subscribe to Company's Investment Certificates

DETROIT, Dec. 26—Plans for the distribution of \$10,000,000 in bonus money, to its 90,000 employees, have been announced by the Ford Motor Co., and will be carried into effect immediately. The bonuses range from \$50 to \$270 and will be paid in cash to employees according to their daily income and the length of time in the continuous employ of the company.

Following is the scale in accordance with which the bonuses will be distributed to employees on daily wage and on salaries of less than \$250 a month.

Men hired prior to Oct. 1, 1914—\$6 a day men, \$150; \$6.40 men, \$160; \$6.80 men, \$170; \$7.20 men, \$180; \$7.60 men, \$190; \$8 men, \$200; \$8.40 men, \$210; \$8.80 men, \$220; \$9.20 men, \$230; \$9.60 men, \$240; \$10 men, \$250; \$10.40 men, \$260; \$10.80 men, \$270.

Men hired prior to Oct. 1, 1915, range from the \$6 a day man who received \$130 bonus, to the \$10.80 man who received \$250.

Men hired prior to Oct. 1, 1916; \$110 to \$230.

Men hired prior to Oct. 1, 1917; \$90 to \$210.

Men hired prior to Oct. 1, 1918; \$70 to \$190.

Men hired prior to Oct. 1, 1919; \$50 to \$170.

The distribution of profits with wages will continue as in the past, in accordance with a plan in effect since Jan. 12, 1914. In addition to this the company plans to distribute a bonus annually, if in the judgment of directors, the earnings permit.

Coincident with the bonuses, the company announces its intention to offer Ford Investment Certificates, in which those employees who wish to share in the profits of the company may invest a certain portion of their incomes. The certificates will be issued in \$100, \$500, and \$1,000 denominations. They are non-negotiable and non-assignable, and only persons in actual and active employ of the Ford company will be permitted to hold them.

The certificates bear a guaranteed annual interest of 6 per cent and in addition further payments may be made semi-annually at a fixed rate if earnings permit. In case of the death of an employee certificates become payable at once to his personal representative, plus interest, but the company reserves the right to require thirty days' notice in writing of the intention of an employee to demand payment of certificates. A certificate standing in the name of a deceased employee may continue, at the discretion of the company, to draw interest and payments for his dependents.

So as not to discourage the savings habit or tempt employees to withdraw any savings accounts to buy certificates, the company will permit the purchases of certificates only up to an amount equal to one-third of the employees' salary. The employee can, however, use all of his bonus money for investment in certificates, if he so desires. The right is reserved by directors of the company, to take up for cash at any time, and on stipulated terms, any or all certificates held by employees.

Speaking for the Ford organization,

Publication of this issue of Automotive Industries has been delayed until Jan. 5 by conditions over which the publishers have had no control. Further issues will be forthcoming as rapidly as they can be printed.

Charles W. Browning, publicity director, said of the company's plans:

"Within the last year Henry Ford and his son Edsel have acquired full and complete ownership and control of the company. This end was sought with the sole purpose in mind of so shaping the policy of the company that the men in its employ may participate to a greater extent than ever before in its prosperity.

"The idea underlying the Ford plan is that justice is greater than charity; that instead of spending money on men and for men in so-called philanthropic ways, it is better to give them the opportunity to work at a wage that enables them to live like men, without charity and by their own efforts to provide for their families and their future and in addition to their wage to give them a share in the prosperity of the company. There is no charity in it."

POUGHKEEPSIE TO SHOW

POUGHKEEPSIE, N. Y., Dec. 22—Poughkeepsie's annual automobile show, under the auspices of the Poughkeepsie Auto Club, will be held in the armory, Feb. 9 to 14. George A. Coleman will be manager.

ST. JOSEPH SHOW SET

ST. JOSEPH, MO., Dec. 22—The annual automobile show of the St. Joseph Automobile Show Association will be held in the auditorium, Mar. 1 to 6, under the direction of John Albus.

CEDAR RAPIDS DATE SET

CEDAR RAPIDS, IA., Dec. 22—The annual automobile show by the Linn County Motor Trades Bureau will be held in the Auditorium, Cedar Rapids, from Feb. 9 to 14.

SALT LAKE CITY SHOW SET

SALT LAKE CITY, Dec. 22—The annual Salt Lake City automobile show will be held Feb. 9 to 14, under the management of W. D. Rishel.

Make Turbine Drive for Passenger Cars

NEW YORK, Dec. 18—The manufacture of a turbine drive for passenger cars has been undertaken in Newark, N. J., by the Radcliffe Turbine Drive Co., Inc., with offices at 177 Broadway, New York. The company already has a considerable force of men that work in the New Jersey factory, and expects to have its product on the market in March next.

The turbine drive, according to its inventor, C. R. Radcliffe, will be manufactured for trucks later on. The appliance will be shown at the New York and Chicago shows.

Arthur M. Day, recently returned from service with the American Expeditionary Forces, is president of the company.

LANCASTER SHOW SET

LANCASTER, O., Dec. 22—The annual automobile show of the Fairfield County Auto Trades Association will be held in the Sherman Memorial, Lancaster, from Jan. 22 to 24. W. H. Payne, of Columbus, O., will manage the show.

ARRANGE DES MOINES SHOW

DES MOINES, Dec. 22—The eleventh motor show of the Des Moines Automobile Dealers' Association will be held Feb. 16 to 21, under the management of Dean Schooler and C. G. Van Vliet. The show will be held in the Ford factory where 113,000 sq. ft. of floor space will be available. Automobiles, trucks and equipment will be shown.

SAN FRANCISCO SHOW SET

SAN FRANCISCO, Dec. 22—The Fourth Annual Pacific Automobile Show will be held Feb. 21 to 28 in the Exposition Auditorium under the auspices of the Motor Car Dealers' Association of San Francisco. G. A. Wahlgreen has been appointed manager.

SET SPRINGFIELD SHOW

SPRINGFIELD, MASS., Dec. 22—Springfield's annual automobile show will be held in the auditorium, March 1 to 6, under the auspices of the Springfield Automotive Dealers' Association. Robert H. Clark has been selected as manager.

TO SHOW NEW TRUCK

DETROIT, Dec. 17—The latest model Air-O-Flex truck will be completed Jan. 1, according to announcement of G. M. Walker, Jr., president of the Air-O-Flex Automobile Corp.

OPENS NEW YORK OFFICE

NEW YORK, Dec. 20—Announcement is made that Theodore F. MacManus, Inc., will establish offices in New York after Jan. 1, retaining its central offices in Detroit. MacManus will continue as advertising counsel of the Republic Truck Co., Inc., and Tornbenson Axle Co.

FRANCE CONTRACTS FOR SURPLUS TOOLS

Commission Will Select \$25,000,000 Worth of Army's Machine Stock

WASHINGTON, Dec. 22—The director of sales of the War Department has entered into a contract with France, under which that government will be permitted to purchase \$25,000,000 worth of surplus machine tools. The French government is to pay for the tools in ten years, 5 per cent bonds, which at maturity, are payable in dollars at Washington in gold coin of the United States.

Developments Large on Lincoln Highway

NEW YORK, Dec. 23—A recent report of the Lincoln Highway Association, shows that gigantic strides were taken in 1919 in the development of America's first transcontinental road, and that the plans for 1920 promise even greater development.

More than \$9,000,000 has been invested in the various states on the highway during the year, according to the association's figures. In the majority of states federal aid has largely augmented the state and county funds, the route having been established as a federal aid road to be improved directly under the inspection of the Government for more than three-quarters of its total distance between New York and San Francisco.

Expenditures in the various states for new construction, reconstruction and maintenance included:

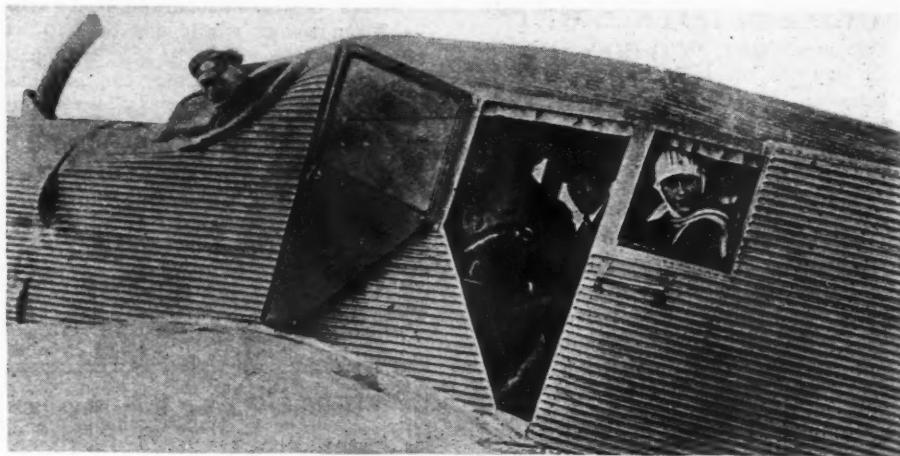
New Jersey	\$1,383,572.00
Pennsylvania	1,418,169.28
Ohio	1,903,708.10
Indiana	742,218.30
Illinois	1,430,120.28
Iowa	256,899.29
Nebraska	613,025.00
Wyoming	127,009.94
Utah	225,528.54
Nevada	411,049.58
California	375,500.00

\$8,886,800.31

To this must be added much of the county construction and maintenance work and city paving for which it is impossible to get accurate detailed figures. Conservative estimate places this amount above \$500,000.

DAYTON SHOW IN JANUARY

DAYTON, O., Dec. 20—Dates for the annual Dayton automobile show have been tentatively set for Jan. 12 to 17. The show will be held in Borchers Auto Co.'s new building and will be under the direction of the Dayton Auto Trades Association. H. C. Phelps is director and B. J. Borchers chairman of committees.



New Type of Metal Airplane

Here's a view of the pilot's seat and cabin of the Junker metal airplane, for which the Germans claim a new altitude record for a machine bearing passengers. It attained an altitude of 6,750 meters with eight passengers

Navy Calls Army

Air Witness Unfair

WASHINGTON, Dec. 19—Secretary of the Navy Daniels has protested to the Secretary of War and to Chairman D. R. Anthony of the House Military Committee, against certain testimony given by Brig. Gen. William Mitchell, of the Army Air Service, and two of his assistants, which interferes with and discredits the business and policies of the Navy Department on the subject of a separate naval air service.

Daniels in his letter to Secretary Baker says: "This reply is simply an expression of opinion on the part of General Mitchell, which however, is incorrect. The majority of the aviators of the regular Navy are united in opposition to the United Air Service as has been proposed, which is regarded to be fallacious in conception and hence unworkable in practice."

Daniels calls special attention to the fact that the Army was trying to get hold of the German dirigible L-72 in violation of the agreement that there should be no duplication of effort on the part of the Army and Navy. Also it is pointed out by Daniels that Maj. F. D. Foulous is quoted as having said that he by "accident" discovered that the Navy was starting in Paris a separate bombing offensive against the German submarine bases. Daniels says that whatever was done was with the approval of General Pershing and A. E. F. headquarters.

DENY TRUCK RUMOR

NEW YORK, Dec. 22—The Willys-Overland Co., Toledo, has denied the rumor, prevalent in the trade circles for the past few weeks, that company is planning to bring out a light truck.

TRENTON SHOW IN MARCH

TRENTON, N. J., Dec. 20—Trenton's annual automobile show will be held March 20 to 27 in the armory under the auspices of the Trenton Automobile Dealers' Association. It will be under the management of John L. Brock.

Manufacturers Seek

Sites in Canada

TORONTO, Dec. 22—Dodge Brothers will erect a Canadian plant either at Weston (a suburb of Toronto) or Windsor during 1920. A score of other American automotive companies, several English ones, and Fiat of Italy are reported to have purchased, or to be searching for sites in Ontario for plants. Commerce Motor Car Co. will start building immediately in Windsor. Fiat has decided on Toronto for the location of its imperial assembly plant.

Whether Walkerville or Oshawa (if either) will get the Cadillac and Scripps-Booth plants is a matter of controversy in trade circles. Paige, also Hupp, as far as can be ascertained, has not decided on the location of a Canadian factory though the propinquity of the Ontario border cities along the Detroit river to parent plants is not likely to be overlooked.

GRAND RAPIDS SHOW SET

GRAND RAPIDS, MICH., Dec. 20—The annual automobile shows of the Automobile Business Association will be held Feb. 23 to 28, and March 1 to 6; the first week being for passenger cars and the second for commercial vehicles. The show will be held in the Furniture Exposition Building and will be under the management of M. D. Elgin.

E-B MANAGERS MEET

ROCKFORD, ILL., Dec. 20—Representatives from 15 branches of the Emerson-Brantingham Implement Co. attended the fifth annual sales convention of the company held at the general offices in Rockford, Dec. 16-20. A. T. Jackson, vice-president and general salesmanager, was chairman of the convention.

Associated with the conference were the assistant managers, credit and collection managers, works managers and members of the E-B development club.

DETROIT RESUMES
CAPACITY OPERATIONAll Plans Again Under Full
Headway Following Fuel
Ban Removal

DETROIT, Dec. 17—With the return to work today of the last of the employees of the Studebaker Corp. of America and the Hayes Manufacturing Co., idle since the fuel ban was placed on the automobile industry, all plants now are operating full shifts on normal schedules. More than 70,000 men in the industry were thrown out of employment for periods ranging from one to ten days, the loss in wages alone being estimated at between \$1,500,000 and \$2,000,000.

The actual loss to the manufacturers cannot be computed with any degree of certainty. The loss of business to manufacturers and dealers, whose customers gave up all thought of buying cars with the fuel ban delay, retarding production already far behind the demand, and the loss of highly-trained mechanics, lured to more favored cities, will fall heavily.

President Dow of the Detroit-Edison Co. announced that continued operation of Detroit industries was contingent on the railroad and fuel administrations making good their promises to have a normal supply of coal moving into Detroit by Saturday. The power company is nearing rock bottom with its fuel supply but has been assured that the normal daily shipment now is in transit from the mines and promised daily deliveries on the pre-strike basis.

LINK SERVICE STATIONS

NEW YORK, Dec. 20—In order better to meet the service needs of Buick owners in the metropolitan district, the Buick Motor Co. in New York has begun the organization of a chain of service stations in Manhattan, the

Bronx, Brooklyn and northern New Jersey to be operated directly under the management of the New York company. The stations will be conducted under the name of the Buick Authorized Service, Inc., which will be a department of the general organization in New York.

The Buick management has been working quietly on the plan for several months and has twelve service stations in operation or about to be opened.

Bootlegging Cars

Released by Courts

CHICAGO, Dec. 20—Trucks and motor cars seized while carrying liquor cannot be confiscated in the enforcement of the search and seizure law in Illinois, according to a decision handed down this week by the Illinois Supreme Court. The court held that part of the act illegal which called for confiscation of motor vehicles engaged in unlawful transportation of liquor and by this action automatically released several score of trucks and cars now being held by authorities, at the same time cancelling bonds which were put up by other owners to secure the release of their vehicles.

NEW AIR SERVICE BILL

WASHINGTON, Dec. 19—The establishment of an airplane mail service between Pittsburgh and Kansas City would be authorized by a bill introduced by Congressman Kelley of Pennsylvania. The bill also authorizes the operation of air-mail service at such additional points between these two cities as might be arranged for by the Postmaster General.

1920 OFFICERS NAMED

AKRON, O., Dec. 22—Officers elected for 1920 by the Akron-Williams Co. are: F. E. Holcomb, president; S. F. Ziliox, vice-president; G. Carl Dietz, treasurer; William J. Slater, secretary and assistant treasurer; Charles Reymann, Charles Herberich and A. W. Burnett, additional directors.

Entry Blanks Out

for Indianapolis

INDIANAPOLIS, Dec. 20—Entry blanks have been mailed for the Seventh International 500 Mile race on the Indianapolis Speedway, Monday, May 31, 1920. The 1920 race will be the first to be held under the new Speedway rules limiting competition to cars of 183 cu. in. piston displacement. Since the preliminary conditions of the race were announced, some time ago, modifications have been made lowering the weight of eligible cars from 1,700 to 1,620 lbs., and making right hand drive optional instead of compulsory. The weight reduction was put into effect in order to make the Indianapolis racing rules conform with those of the Grand Prix de France, scheduled for Le Mans next fall.

PLAN TORONTO SHOW

TORONTO, Dec. 22—if the Ontario Motor League is successful in securing the Toronto Armories for a show there will be a motor show here, probably in February. The Toronto Automobile Trade Association has induced the league to use its good offices with the military authorities. It is felt, in view of the prodigious war time service rendered by the league, that the military authorities will meet their request.

HEADS CANADA BRANCH

DETROIT, Dec. 22—R. H. Jeffers, manager of the Detroit branch of the Firestone Tire & Rubber Co., has been named general manager of the new Firestone factory at Hamilton, Ont., where operation is promised within five months. Announcement of the plan to establish a plant at Hamilton was made some time ago. The Canadian company will have a capital of \$5,000,000 and the new plant will have an output of 3,500 tires a day, 2,000 persons being employed in their manufacture.



Great Collection of Automobiles in American Camp in France

This is a photograph of the great automobile park in the American camp of Romorantin, France, showing hundreds of ambulances and trucks falling to pieces from prolonged inactivity and exposure, after having completed a valiant tour or duty during hostilities.

TOWNSEND SUBMITS
NEW HIGHWAY BILL

Provides for Federal Commission to Plan and Build National System

WASHINGTON, Dec. 22—A revised bill, for the establishment of a National Highway System and the creation of a Federal Highway Commission, has been introduced in the Senate by Senator Townsend. The bill, which closely follows the earlier bills which were introduced by Senator Townsend for the same purpose, would create a Federal Highway Commission of five commissioners appointed by the President with the consent of the Senate, each being appointed with regard to the geological conditions of the United States and under the provision that not more than three commissioners shall be members of the same political party.

The Commission will establish, construct and maintain a national system of highways composed of connecting interstate roads which shall be the most practicable routes and constructed with consideration for the location of agricultural and industrial production centers. The system may include the highways connecting water ports and the highways of Mexico and Canada. They will not include highways in a municipality with a population of 5,000 or more.

The commission will have authority to make the necessary surveys and maps, either directly or through contract with state highway departments, will have the power to hire labor and purchase supplies and maintain equipment and will work co-operatively with state highway departments in the selection of highways.

APPORTIONMENT TO STATES

A portion of the national highway system in each state shall be equal to 1 per cent of the total highway mileage in each state where that will suffice to offer at least two highways connecting with the national highways in adjoining states. Where it will not be sufficient the commission will have the power to increase the mileage of the national systems as much as is necessary to provide two such highways. It may select any highway or part of a highway for its national highway system that has been constructed by the state or county municipality.

In consideration of the benefits to be derived by each state from the establishment of a national highway system it will be a condition preceding construction of the highways selected for the national system that the existing right of way of a highway will be transferred by the state to the United States government. Permission is given to railroads or canal companies to convey property to the government for the purpose of this act if it has been acquired by grant from the United States.

Provision is made to allow the transfer of public lands or reservations belonging to the United States when they are reasonably necessary for the establishment of a national system.

PROVIDES SPECIFICATIONS

The use of only such durable types of surface and materials as will adequately meet the future traffic needs is authorized, and the commission will have the authority and power to determine the types of construction, methods and maintenance. All highways in the national system unless impractical because of physical conditions, excessive cost or legal obstacles shall have a right of way of not less than 66 ft. in width and a wearing surface of an adequate width of not less than 20 ft.

The bill will transfer the powers and duties relating to highways or public roads, now in the hands of the Bureau of Public Roads, Department of Agriculture, together with the various employees and appropriations, to the Federal Highway Commission.

Appropriations authorized by the act include \$50,000,000 which will become available immediately, \$75,000,000 for the fiscal year beginning July 1, 1920, and \$100,000,000 for each of the three succeeding fiscal years, in all \$425,000,000 will be available until expended. Not more than 5 per cent of the appropriation may be used for administering the provisions of the act.

The bill is now before the committee for post offices and post roads for consideration.

Detroit Plans 100
Buses in Spring

DETROIT, Dec. 18—Henry M. Leland, of the Lincoln Motor Co., stressed the need of motor buses to relieve the Detroit transportation problem at a mass meeting in the Board of Commerce, declaring skilled employees were leaving the city daily on account of insufficient transportation facilities. He declared he lost an excellent worker last week because the man lived five miles from his plant and was dependent on inadequate street car service. He expressed the hope that surface lines would be abolished entirely in favor of subways with motor buses taking care of the short jumps in the downtown section. The motor bus was advocated by other civic leaders and the plan to put 100 in operation in the spring appears assured.

PROMOTE TRIESTE SALES

WASHINGTON, Dec. 18—There will be an excellent opportunity for American exporters to display their goods at the permanent samples exhibition to be held at Trieste under the auspices of the Chamber of Commerce, according to advice received from Consul O'Hara. The special building to be erected for this purpose will be ready for occupancy next summer.

Name Pan American
Conference Groups

WASHINGTON, Dec. 22—Group committees have been appointed by Secretary Glass of the Treasury Department to take part in the second Pan American Financial Conference which will be held in Washington Jan. 12 to 17, 1920. These committees will join with the secretary in consulting the Ministers of Finances and other official delegates sent by the Latin-American governments, and will sit in executive session with the Latin-American delegation during the conference.

Henry Ford and E. N. Hurley are two of the members of the committee which will meet with the representatives of Argentina. John J. Raskob of the General Motors Corp. is a member of the committee which will confer with the Chilean delegation. R. C. Haskins of the International Harvester Co. will sit with the committee meeting the Colombian representatives. Samuel P. Colt, U. S. Rubber Co., will serve on the committee conferring with the Honduras representatives.

CEYLON CUTS DUTIES ON
IMPORTED CARS

WASHINGTON, Dec. 18—Ceylon should be an excellent market for motor cars following the radical cut in important duties. The progressive increase of the import duty during the war period, which finally reached a 100 per cent duty, severely curtailed and finally accomplished the desired purposes of practically prohibiting such importations, as is shown by the following figures, which also indicate the normal amount imported and the shortage created by the restrictive measures, according to a common report:

1911.....	213	cars
1912.....	239	"
1913.....	407	"
1914.....	459	"
1915.....	296	"
1916.....	570	"
1917.....	126	"
1918.....	10	"

The reduction of the duty on motor cars on Mar. 7, 1919, to 7½ per cent, removed the barrier, and by July 31, 1919, 76 motor cars had been imported, of which all but five were of American manufacture. Motor trucks and motorcycles were not subjected to the heavy war-time duties. The importation of motor trucks was:

1915.....	23	cars
1916.....	39	"
1917.....	32	"

For the first seven months of 1919 there were 73 motorcycles imported, of which forty-two came from the United States. There are at the present time about 3500 motor cars, 200 motor trucks, and 1200 motorcycles of 40.8 per cent in the wages paid in Ceylon.

Murray Co. Sales

\$4,082,437 in 1919

DETROIT, Dec. 20—The rapid rise of the J. W. Murray Manufacturing Co. in the automotive industry is revealed in the listing of the stock on the Detroit exchange, the report showing, among other things, sales in 1919 of \$4,082,437 as against \$93,944 in 1913.

The company was organized in 1913 with J. W. Murray, president, and J. R. Murray, secretary and treasurer, for the manufacture of hoods, fenders, tanks, underpans, mufflers, battery boxes and general sheet metal parts for automobiles. The company started with a cash investment of \$20,000 and today has a net worth of \$1,534,380, and total assets of \$2,032,645. Net profits for the years 1916, 17, 18 and 19 show a total of \$1,201,794.63.

The company's dividend record is equally interesting. Cash and stock distribution since the organization totals \$924,945. The company is paying 12 per cent a year on \$700,000 outstanding. The authorized total is \$2,000,000 with par \$10 a share. The concern's growth in physical assets, buildings, machinery and equipment has been almost entirely from reinvestment of surplus funds. It is the largest manufacturer of hoods and fenders in the world and employs 1,000 men. Business in excess of \$5,000,000 is predicted in 1920.

British Trades for

Big Organization

LONDON, Nov. 26 (Special Correspondence)—As a result of the ballot of the engineering trade unions on the amalgamation proposals, 239,645

votes were cast in favor of the scheme and 42,665 against. The object of the scheme is to include in one union, 500,000 workers, with funds amounting to nearly \$17,500,000.

Eight societies succeeded in securing the number of votes required to give force to the decision. These were the Amalgamated Society of Engineers, the United Machine Workers' Association, the United Smiths and Strikers, the Steam Engine Makers' Society, the Associated Brass-founders, Turners, Fitters, Finishers and Coppersmiths' Society, the Amalgamated Instrument Makers' Society, the North of England Brass Turners, Fitters and Finishers' Society. Seven societies failed to secure the requisite number of votes.

Detroit Exhibits to
Travel Freight

DETROIT, Dec. 22—Freight cars rather than the special baggage coaches will carry Detroit's contributions to the New York automobile show. Like the thoroughbred race horse which in war time was deprived of his equine palace car and relegated to the slow freight class, highly-polished sedans and limousines will be blocked to the floors of rolling stock that ordinarily is used for the more plebian commodities shunted about the country.

And all because of the edict of the Railroad Administration resulting from the shortage of rolling stock

PLAN CANADIAN BRANCH

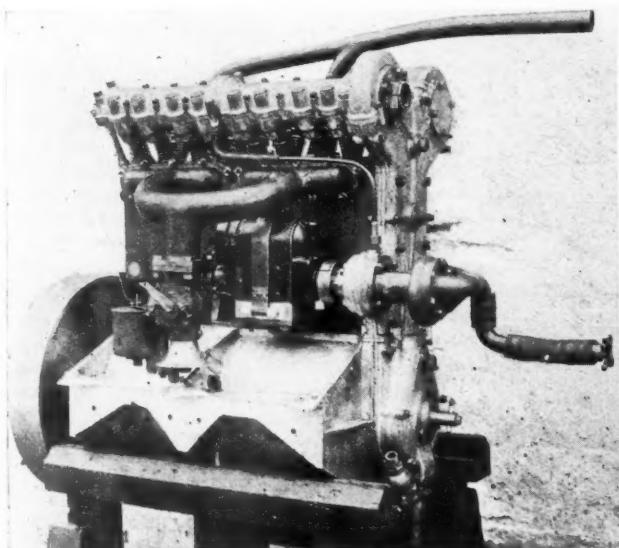
TORONTO, Dec. 22—The Willard Storage Battery Co. has decided to erect a plant in Canada. Site options are said to have been obtained at Toronto, Oshawa and Windsor.

British to Enlarge
on Tractor Trial

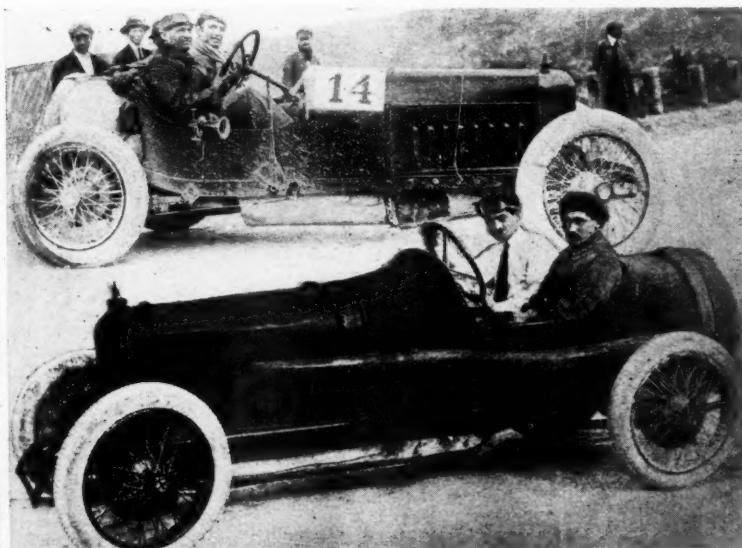
LONDON, Nov. 25—(Special Correspondence)—The Society of Motor Manufacturers and Traders, Ltd., has decided to hold a tractor trial in 1920. It is now stated officially that the event will be of a much more ambitious character than this year's autumn trial. H. Scott Hall is again organizer for next year's trials, and letters on the matter should be sent to him at the office of the S. M. M. & T., 83 Pall Mall, London, S. W. 1.

This event should stimulate American makers of such farming plants as silo, drain culture and clearers and motor trenching tools, etc., to make a bid for the market here. At present this class of plant is only known by pictures of its use, and some of it in connection with war work.

Having regard to the new phase of agriculture here, and the certainty that British farming must be reformed and moulded to make more use of science in culture and land treatment. Enterprise of this sort would be worth the effort, provided that the makers interested will survey and become personally informed of British conditions. They must allow for a certain amount of educational "spade work." The comparative failure to make British farmers take to the 14 in. plough is a point not to be overlooked in connection with this and other developments of new tractor implements.—Englishman.



Peugeot 4-cylinder racing engine of 153 cu. in. capacity which won the Targa Florio Race recently held in Italy



Above—Ascaris in Grand Prix Fiat. Car made fastest time of day on first 30 km., then dropped down a ravine 70 ft. deep. Below—Andre Boillot, winner of the Targa Florio in his 153 cu. in. Peugeot

ADOPTS STANDARDS FOR ARMY FLIERS

New Physical Requirements Designed to Reduce Acci- dents in Air Service

WASHINGTON, Dec. 20—Sixty per cent of the British air casualties in the first year of the war were due to physical unfitness of fliers and not to faulty airplanes or enemy fire, according to a report just issued by the Surgeon General of the U. S. Army. This figure was reduced to 30 per cent in the second year and 12 per cent in the third year by the careful selection of candidates and by medical care of the fliers. The extraordinary importance of selecting fliers who are physically fit and of keeping them in such condition is being rapidly accepted by all authorities.

The International Air Navigation Convention of the allied and associated powers, held recently, agreed upon certain medical requirements that every candidate must fulfill before his license can be issued to him as a pilot, navigator or engineer of aircraft. The U. S. Army Air Service has recently issued an order whereby all fliers and enlisted men of flying status, including observers, will be subjected to physical examination in January and July of each year.

Following are the medical requirements as stipulated by the International Air Navigation Convention:

(a) Good family and personal history.

with particular reference to nervous stability. Absence of any mental, moral or physical defect which will interfere with flying efficiency.

(b) The minimum age for pilots and navigators engaged in public transport shall be 19 years.

(c) General Surgical Examination—The aeronaut must neither suffer from any wound, in or operation nor possess any abnormality, congenital or otherwise, which will interfere with the efficient and safe handling of aircraft.

(d) General Medical Examination—The aeronaut must not suffer from any disease or disability which renders him liable suddenly to become incompetent in the management of aircraft. He must possess heart, lungs, kidneys and nervous system capable of withstanding the effects of altitude and also the effects of prolonged flight.

(e) Eye Examination—The aeronaut must possess a degree of visual acuity compatible with the efficient performance of his duties. No pilot or navigator shall have more than two dioptres of latent hypermetropia; muscle balance must be good and commensurate with the refraction. He must have a good field of vision in each eye and must possess normal color perception.

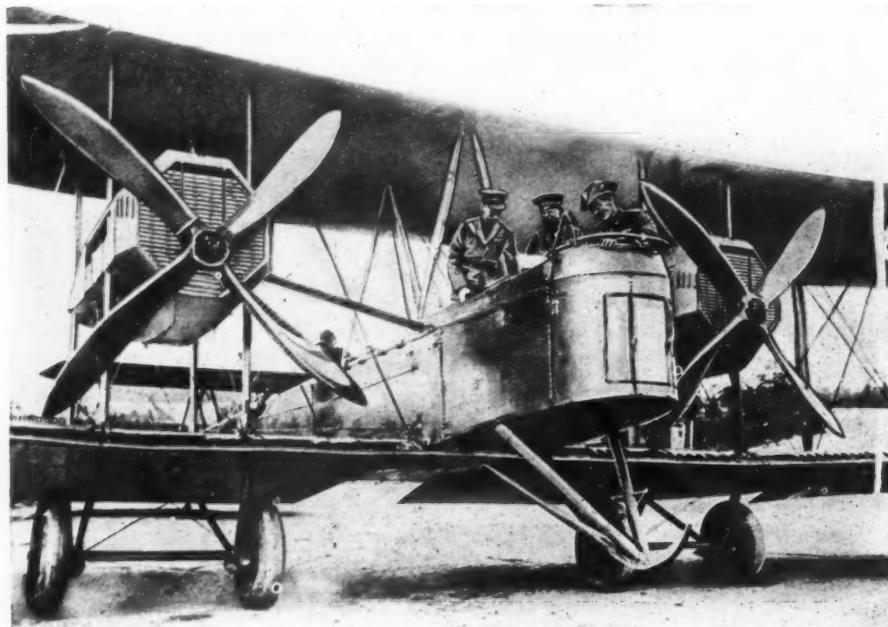
(f) Ear Examination—The middle ear must be healthy. The aeronaut must possess a degree of auditory acuity compatible with the efficient performance of his duties.

(g) The vestibular mechanism must be intact and neither unduly hypersensitive or hyposensitive.

(h) Nose and Throat Examination—The aeronaut must possess free nasal air entry on either side and not suffer from serious acute or chronic affections of the upper respiratory tract.

MUSKEGON SETS SHOW

MUSKEGON, MICH., Dec. 22—The annual automobile show of the Muskegon Auto Business Men's Association will be held in the Armory, Mar. 7 to 13, under the direction of J. C. Fowler.



England to Australia in 28 Days

Captain Ross Smith is shown in this photograph in his Vickers-Vimy Airplane, which recently completed the England to Australia journey of 11,500 mi. in 28 days, winning the prize of 10,000 pounds (\$46,000) offered by the Australian government.

BRITISH COMBINE TO SWELL PRODUCTION

Merger of Four Big Companies Important Step in Busi- ness Development

LONDON, Dec. 5—(By Mail)—The American Chamber of Commerce in London reports a £6,000,000 (nominally \$30,000,000) combine in the British motor industry, which is the first really big step toward mass production in that country.

The new company will be known as Harper, Bean, Ltd., and will include such firms as A. Harper & Sons & Bean, iron founders of Dudley; Vulcan Motor & Engineering Co. of Stourport; Swift of Coventry; the British Motor Trading Corp.; Hadfields Ltd., steel manufacturers of Sheffield; as well as a number of subsidiary manufacturers of electric lighting and starting sets, jigs and tools, radiators and equipment. In this way the amalgamation will control the manufacture of all component parts.

The American Chamber in London understands that the designs have been standardized, and that production will begin immediately at the rate of 50 cars per week in January; increasing to 300 per week in July, 1920; to 600 per week in the following December; rising ultimately to an output of 2,000 per week in 1923.

The ultimate production will be split three ways to include 50,000 of the small car, 25,000 of the medium car and 25,000 of the commercial vehicle.

Employees will be given a tangible interest in the results by the setting aside of 500,000 paid up ordinary shares as a benevolent fund for them and their dependents, the income from which will be distributed by a committee of six directors and six employees.

Select Site for Toronto Airdrome

TORONTO, Dec. 17—Fifty acres of land on the Harbor Improvement property at the foot of Bathurst street has been tentatively set aside as the site of Toronto's civic airdrome. The property is valued at upwards of \$2,000,000. As soon as the city council sees fit to transmute the tentative into absolute a number of American as well as British and Canadian airplane companies have stated they will purchase factory and hangar sites alongside the public landing ground.

ATLANTA CO. FORMED

ATLANTA, GA., Dec. 22—The Rawson-Upshaw Co. will open an exclusively wholesale automotive equipment, bicycle and supply business, Jan. 1, in Atlanta. Both men were formerly members of the staff of the Elyea Co., Atlanta, from which they withdrew recently to launch their new business.

STAGE TRUCK TOUR IN SNOW AND ICE

Milwaukee Dealers Arrange Trip Through Wisconsin to Show Reliability

MILWAUKEE, Dec. 22—A unique demonstration of the utility of the motor truck in the heart of winter in Wisconsin has been arranged by motor truck dealers of Milwaukee as a corollary of the thirteenth annual Milwaukee show.

The idea of the truck dealers is to make a tour of between 200 and 300 miles in southeastern Wisconsin, lasting about three days and ending in Milwaukee at the Auditorium on the opening day of the big show. Noon and night controls will be designated at which public meetings will be held and talks on motor truck transportation given to business men. The U. S. Department of Agriculture has been invited to send official representative to show the motion pictures taken during the recent National Motor Truck Development Tour which ended in Milwaukee in October.

The Milwaukee dealers' association has been granted the co-operation of numerous organizations in handling the tour. The state bureau of markets, state department of agriculture, the state highway commission, the Good Roads Association of Wisconsin, Milwaukee Association of Commerce and other organizations have agreed to participate.

Jesse A. Smith, president of the Milwaukee dealers, has appointed the following executive committee in charge of the tour: A. E. Adams, Healy-Larson Motor Co., chairman; Frank Meyers, Sterling Motor Truck Co.; M. E. Newald, M. D. Newald & Co.; Roy Osborne, Alfred Reeke Co.; George J. Suess, KisselKar Co.

The Milwaukee Automobile Dealers, Inc., recently opened its member roll to the motor truck distributor and dealers of Milwaukee, who are organizing as a distinct division of the parent body.

Airplane Company Is Formed in Canada

TORONTO, Dec. 22—Bishop-Barker Airplanes, Ltd., has been formed to build, sell and transport by airplanes. The two principals in the corporation, Lieut. Col. Bishop and Lieut. Col. Barker, are both Victoria Cross men, carrying most of the allied decorations in addition, including the Croix de Guerre. Bishop has the highest official record of Hun planes of any living aviator. Barker stands second among Canadian aces.

The company has purchased the Canadian training planes from Ericson who bought them from the Imperial Munitions Board, and are importing one hundred and fifty planes at present from England. Major Joy states that

AUTOMOTIVE INDUSTRIES THE AUTOMOBILE

next spring the company will carry on both pleasure and commercial flying at less than double railroad fare. Airplane transportation of business men from this city to Windsor, Detroit, Buffalo, and other points will cost the passengers approximately seventy-five cents a minute for flying.

Ford to Announce Foreign Expansion

DETROIT, Dec. 22—Invasion of Europe and Asia by the Ford Motor Co., and plans for the establishment of European factories will be announced upon the return of Vice-President F. L. Klingensmith from Europe this week. A large plant in France, operated on the American system but with French labor will be the first big step. The company for some time has maintained branches in Paris and Bordeaux and recently established similar branches in Copenhagen, and in Cadiz, Spain.

Tractor Course for Illinois Students

CHAMPAIGN, Ill., Dec. 18—The division of farm mechanics, college of agriculture, University of Illinois, will conduct a tractor school during January and February, 1920, omitting the two weeks Jan. 19 to 31 in which the annual Corn Growers' and Stockmen's Convention will be in session.

Lecture work in the proposed course will cover the construction, theory, operation, maintenance and repair of gasoline engines and oil burning tractors. Laboratory work will consist of practical work in engine and tractor operation, magnetos, carburetors, engine timing and wiring, trouble work and adjustments. Twelve to fifteen tractors will be used and 25 makes of gas engines.

Another National Increase Announced

INDIANAPOLIS, Dec. 22—For the second time within a few months the National Motor Car & Vehicle Corp., builder of the National Sextette, has announced increased prices.

The new schedule follows:

Touring Car	\$3,500
Phaeton	3,500
Roadster	3,500
Coupe	4,650
Sedan	4,700
Chassis	2,950

The former increase placed the prices as follows: Touring car, \$3,290; Phaeton, \$3,290; Roadster, \$3,290; and Sedan, \$4,250.

SAN ANTONIO SHOW SET

SAN ANTONIO, TEX., Dec. 22—The annual automobile show of the San Antonio Automobile Trade Association will be held Feb. 14 to 22, under the management of W. A. Williamson. The show is not a state wide exhibition but is exclusively a Southwest Texas show.

HOUSE DETROIT SHOW IN FORD BUILDING

New Exhibition Site Will Give Dealers 120,000 sq. ft. for Displays

DETROIT, Dec. 20—Detroit's 1920 automobile show, staged by the Detroit Automobile Dealers' Association, will be held Feb. 14 to 21 in the eight-story Ford service building.

Four floors of the handsome structure, which is located at Woodward Avenue and Grand Boulevard, the heart of the automobile district, will be used for a display of passenger cars, trucks, tractors and equipment. The construction of the Ford building lends itself admirably to the plans for the 1920 show and the fact that each floor contains 30,000 sq. ft. of floor space assures ample room for the great number of vehicles which will be on exhibition.

The space practically is double that available for former shows and the cramped conditions will be eliminated. The dates, so arranged as to not conflict with any of the other large shows, insure a much greater attendance than heretofore.

Nebraska Begins

Tests of Tractors

LINCOLN, NEB., Dec. 20—Equipment is now complete for testing tractors at the University of Nebraska as required by State Law. The first official tractor test was started on Nov. 24, but was not completed on account of the cold weather and snow.

The drawbar testing is to be conducted on an outdoor track. The official testing will be started as early as weather conditions permit in the spring. Applications are now on file for test of 86 different models of tractors. The complete test on each tractor will require between 30 and 40 hours. Three tractors can be under test at the same time. The tests already applied for will keep the equipment busy until late in the summer.

East India Company

Wants Truck Parts

KARACHI, INDIA, Dec. 18—American made parts for 1½ and 2½ ton trucks are wanted by the Empire Engineering Works, Tyehah A. Zimaup, proprietor, Karachi, which is soon to begin building of trucks of this size in its factories here.

Parts wanted include motors, steerings, wormdrive axles, front axles, springs, frames, speedgears, wheels, radiators etc., for right hand driving. Manufacturers who make the parts enumerated are asked to submit complete illustrated trade price lists.

The company in addition to its engineering activities, is agent for the Canadian Ford cars, Ford motor trucks, Fordson tractors, Autocrat motor cars, Stoewer motor cars, Truckmobile trucks, Ferro rowboat motors, Robson oil engines and Suction gas plants.

ESSEX COMPLETES ENDURANCE TEST

A. A. A. Officials Observe Speedway Tryouts in Which Records Are Established

DETROIT, Dec. 20—A series of tests on the Essex car, calculated to demonstrate its durability and performance, has been completed on the Cincinnati Speedway by the Essex Motors Co. The tests were run to conclusion in spite of two interruptions due to inclement weather, from Dec. 4 to Dec. 12. The actual time spent in making the tests, including necessary stops, was 93 hr., during which a distance of 5,870 miles was run.

The tests were run under the sanction of the A. A. A. and the car was continually under observation by the A. A. A. officials. The car was certified by technical observers to be stock in every particular, and timing of the trials was accomplished by electrical timing instruments, checked by stopwatch observation.

A summary of the tests is given in the following tabulation:

Date	Distance
Dec. 4	69,255 mi.
Dec. 4	819 mi.
Dec. 4-5	1790 mi.
Dec. 8	1042 mi.
Dec. 10-11-12	3037.24 mi.
Dec. 10	1539 mi.
Dec. 10-11	2329.51 mi.
Dec. 10-11	2912 mi.
Time	Average Speed
1 hr.	69,255 m. p. h.
12 hr.	68.25 m. p. h.
27 hr. 57 min.	(Stopped for snow)
16 hr. 25 min. 10 sec.	(Stopped for rain)
50 hr.	60.74 m. p. h.
24 hr.	64.13 m. p. h.
36 hr.	64.6 m. p. h.
48 hr.	60.66 m. p. h.

As these figures have never been exceeded for cars in this displacement class, according to Essex officials, application for records will be filed with the A. A. A. The Essex engine has a displacement of 179 cu. in., being a four-cylinder type with 3 3/8 by 5 in. cylinder dimensions. The car had the standard gear ratio of 3 1/2 to 1 and was fitted with 32 by 4 in. Goodyear cords, inflated to 70 lb. pressure. The front tires covered the entire distance of 5,870 miles, and but two changes were made on the rear, these being due to punctures from track splinters and not on account of wear.

EQUIPMENT DESCRIBED

The equipment of the car includes A-C spark plugs, Delco ignition, starting and lighting, Sparton vacuum fuel feed, Hyatt bearings for the gearset, Gemmer steering gear, Spicer universals, Timken bearings for wheels and axles, Harrison radiator, Boyce motometer, and Houck wire wheels. The dash, cowl and instrument board were left in place, but the windshield glass

was removed in accordance with A. A. A. rules for stock car tests. The top and body deck were also removed, but no change was made in the contour of the car to affect the entrance lines in any way. The car had a 12 gal. gasoline tank which necessitated a stop at about every 136 miles. The average consumption was one gal. for about 12.5 miles.

The last 50 hours included a 2 hour stop during which it was necessary to change a cylinder block which had cracked through water freezing in the bottom of the jacket in the interval between the Dec. 8 and Dec. 10 tests. The crack developed during the first part of the 50 hr. run causing irregular performance which made it advisable to change the cylinder block. The 2 hr. required for this change is included in the 50 hr. run, but not in the 36 hr. This accounts for the 4 m. p. h. difference in average speed. It was necessary to change two plugs in No. 1 cylinder, these plug changes being necessitated by the misfiring due to the cracked cylinder block.

SLIGHT WEAR DISCLOSED

Inspection of the car after the run showed inappreciable wear in the cylinder bore and on the pistons, but disclosed the fact that present-day valve material has not as good heat resisting qualities as previous products produced when it was possible to secure a higher tungsten content. This fact excited a great amount of interest among the Essex and Hudson engineers who were present at the test. The test was held as much for the purpose of demonstrating the staying qualities of the car, as to furnish a means of technical observation for the Essex engineering staff.

The average temperature was just below freezing point or at about 30 deg. Fahr., necessitating the use of the shutter equipment, which proved to be valuable in properly regulating the circulating water temperature. The minimum temperature on the track was 18 deg. Fahr. The observers were Fred Wagner, F. E. Edwards, R. A. Leavell and J. Edward Schipper.

EXTEND RACINE PLANT

DETROIT, Dec. 22—The McCord Manufacturing Co. has announced a broad expansion program for the plant of the Racine Manufacturing Co., at Racine, Wis., which was taken into the McCord organization several weeks ago. The Racine unit will continue as a body plant under the old management, manufacturing open and closed bodies. The McCord company controls many plants in Detroit, Chicago and Wyandotte, Mich.

CONVENE IN FORT WORTH

FORT WORTH, TEX., Dec. 22—The Texas Automobile Dealers' Association will hold its fourth annual convention in Fort Worth, Mar. 25 to 27. Committees are already arranging for what is expected to be the largest dealers' convention held in the south.

BAN CAR NAMES IN SERVICE STATION ADS

Court Restraints Practices by Unauthorized Companies in New York

NEW YORK, Dec. 20—Supreme Court Justice Greenbaum has issued an injunction restraining two groups of persons engaged in automobile service work from using conspicuously in advertising, and in the New York Telephone Directory, the names of the Cadillac, Dodge, Hudson and Scripps-Booth. The injunction, applied for jointly by the New York companies representing these makes of cars, was obtained through the activity of the New York Automobile Dealers' Association, which discovered the listings in the telephone book and various forms of advertising.

The defendant in the case, operating under several names, had telephone listings as follows: Cadillac Auto Maintenance Co., Dodge Auto Service Station, etc., in each case, by use of the word auto, the defendants got into the telephone alphabetical list ahead of the salesrooms and service stations operated by metropolitan representatives of the cars mentioned. In addition to the listings, the defendants had advertisements in black type in the Telephone Directory and in other publications with the names Cadillac, Dodge, etc., prominently displayed and telephone numbers given alongside.

The complainants charged that both the telephone listings and the advertisements were misleading in that automobile owners would be led to believe that they were announcements of the Cadillac, Dodge, etc., companies.

Milburn Wagon Co.

Has \$900,000 Fire

DETROIT, Dec. 20—The Milburn Wagon Co. suffered a loss of \$900,000, including 30 complete electrics and many automobile bodies, in a fire that destroyed a portion of the plant at Auburndale, a suburb of Toledo, O., Tuesday. The blaze started in the finishing and assembly departments and the entire east section of the factory was gutted. All of the offices of the company were in the burned section though valuable papers and blue-prints were locked in vaults and were saved. The loss was covered fully by insurance.

More than 1,000 men were thrown out of employment temporarily by the fire and many of them lost their tools. President H. W. Suydam said negotiations would be entered into for the construction of new buildings. The offices are located temporarily in the Red Cross building at 228 Superior street, Toledo.

The company was engaged in making bodies for the Olds Motor Works and other automobile companies besides finished electric cars, and was at the height of its busiest season.

PROPOSE U. S. FARM ENGINEERING BUREAU

Bill Would Create Department to Stimulate Use of Me- chanical Appliances

WASHINGTON, Dec. 22—The establishment of a Bureau of Agricultural Engineering to test and certify farm tractors would be authorized by a bill introduced by Representative Anderson into Congress. The bill would establish a Bureau of Agricultural Engineering under a director and would authorize the bureau to acquire and disseminate information about agricultural engineering, including the design, construction, testing, certification, standardization, repair, operation and economics of farm engines, farm lighting and other mechanical farm operating equipment.

NEW CHARTERS GRANTED

DETROIT, Dec. 17—The following new charters were granted by the secretary of state of Michigan:

Rex Machine & Tool Co., Jackson, \$10,000, general machine and tool business; Joseph Ostyn, president.

Moss-Schury Manufacturing Co., Detroit, \$20,000, manufacture and sale of fuse plugs and electrical and gas appliances; George B. Graves, president.

Monarch Carburetor Lock Co., of Michigan, Detroit, \$25,000, distribution of automobile locks and automatic accessories; Jacob W. Allgazo, president.

Stecker Motor & Armature Co., Detroit, \$3,000, dealing in and repairing electric motors, equipment and parts; Edwin L. Stecker, president.

Wayne Radiator Co., Detroit, \$10,000, to design, repair and manufacture automobile radiators, fenders, bodies and lamps; Victor Hanstrom, president.

Permission to increase the capitalization from \$15,000 to \$70,000 was granted the F. F. Wood Motor Co., Grand Rapids, and the Briscoe Devices Co., of Jackson, was granted permission to increase its capital from \$40,000 to \$75,000.

Decrease in its capitalization from \$150,000 to \$15,000 was allowed the Pontiac Body Co.

HENRI FOURNIER DEAD

(By cable to Automotive Industries)

PARIS, Dec. 21—Henri Fournier, a pioneer French racing driver, is dead here.

Henri Fournier was the winner of the Paris-Bordeaux race in 1901, covering the distance of 327 miles in 6 hr. 10 m. 44s., at the rate of 53 m.p.h., which was a new record for the time. He drove a 60 h.p. Mors car. Fournier added further to his laurels by winning the Paris-Berlin race, which was run in three stages in 1901. His time for this race was 16 hr. 5 m. Later Fournier came to this country and joined the Searchmont Automobile Co. of Philadelphia, which was reorganized as the Fournier-Searchmont Co. to capitalize his fame as a race driver. The

venture did not prove a success, however, and Fournier, after a somewhat varied career as a driver and promoter, returned to his native land.

Davis Appointed Eisemann Manager

BROOKLYN, Dec. 21—Charles E. Davis has been appointed general manager of the Eisemann Magneto Corp., succeeding W. E. Steinback, resigned. Davis is a graduate of Worcester Polytechnic. He recently has been acting as a member of the technical section of the Army War Claims Board, at Washington. Davis was released from the service to accept his present position with the Eisemann Corp.



A Lighthouse for Airmen

This lighthouse has been erected at Hounslow Airdrome, England, to guide airmen at night. It throws upward a brilliant beam of light produced by acetylene gas.

IMPROVE TRANSMISSION

SYRACUSE, N. Y., Dec. 20—The Durston Gear Corp., of Syracuse, N. Y., has doubled the size and capacity of its plant within the past few months. It has also recently brought out a new model transmission. The gears and shafts are nickel steel throughout. The main shaft is mounted on annular ball bearings, and the countershaft gear-set is of the cluster type, rotating on a fixed shaft. Easy shifting of gears is one of the prominent features of this new model.

GET BRITISH PLANES

TORONTO, Dec. 22—One hundred and sixty up-to-date airplanes are on their way to Canada from England, the gift of the British Government to the Air Ministry of the Dominion. They will be distributed among the Universities of Toronto, McGill and Alberta, where "air" courses are now part of the curriculum.

Financial News

Autosales Corp. reports gross sales for the ten months ended Oct. 31, of \$2,500,000, an increase of 32 per cent over 1918. Net earnings gained 56 per cent in the same period. Earnings in 1919 are expected to approximate 7 per cent or \$3.50 a share, on the common stock after 6 per cent preferred dividends.

Liberty Motor Car Co. has declared a dividend of 2½ per cent on the common stock, payable Jan. 1 to holders of record Dec. 20.

Saxon Motor Car Corp., in a statement filed with the Detroit Stock Exchange, shows total assets, on Nov. 1, of \$7,103,410, with current assets of \$2,230,823 and net working capital of \$2,138,526. Current liabilities total \$92,405, and other liabilities, \$2,450,000, leaving a surplus of \$4,541,011. Liquidation losses of \$142,157 in the ten months ended Oct. 31 are shown.

Smalley General Co., Inc., Bay City, Mich., has increased its capitalization from \$50,000 to \$525,000 all of which is paid up.

Paige-Detroit Motor Car Co. net earnings for 1919, before taxes, will probably reach \$2,500,000 or more than eight times the annual dividend requirement. Brokers announce the closing of the company's \$3,000,000 7 per cent preferred stock syndicate all of the stock having been sold.

Bethlehem Motors Corp., in its statement submitted to the New York stock exchange for the five months ended Nov. 30, 1919, shows net profits after charges and taxes of \$140,681, equivalent to \$1.08 per share earned on the 130,000 shares of no par value outstanding on the above date.

Portage Rubber Co., upon the order of its directors, will pay a quarterly dividend of 1½ per cent on Jan. 1, 1920, on the preferred stock outstanding and of record Dec. 20, 1919.

NEW ZEALAND STAGES SHOW

NEW YORK, Dec. 23—The Olympia Motor Exhibition, in Christ church, N. Z., proved a huge success, according to W. J. Matthieson, of Adams, Ltd., importers of Studebaker cars.

To help boost the industry along in Christchurch, the Sun carried a 12-page automobile supplement called the "Sun Special Motor Edition."

ARRANGE MADISON SHOW

MADISON, WIS., Dec. 22—The annual Madison automobile show will be held some time about March 1, under the auspices of the automotive division of the Association of Commerce. Don E. Mowry is to be manager.

Leach-Biltwell Buys**Republic Truck Plant**

NEW YORK, Dec. 20—The Leach-Biltwell Motor Co., of Los Angeles, which recently announced a six-cylinder passenger car called the Leach Power Plus Six, has purchased the plant of the Republic Truck Co. in Los Angeles.

The purchase gives the Leach-Biltwell company a 12-acre plot with three large buildings, besides office building, dry kiln, pump house, loading dock, spur tracks, etc. The plant is three miles from Los Angeles with direct Santa Fe railroad connections. It cost \$350,000.

Announcement of the incorporation of the Leach-Biltwell Motor Co. was made last September. M. A. Leach is president. Leach established the Pacific Coast distributing connections for the Dort Motor Car Co., and operated as distributor in Los Angeles and San Francisco. Later he formed the Leach Motor Car Co. and for the past year has been turning out custom made cars. This company was absorbed in the organization of the \$1,000,000 Leach-Biltwell firm. At the time of the incorporation it was announced that the company would buy its units in the east and assemble them in the Los Angeles plant.

CANADIAN PLANTS GROW

TORONTO, Dec. 22—The Canadian National Carbon Co., Ltd., and the Prest-O-Lite Co., of Canada, Ltd., have jointly purchased ten acres of the Hill Crest Driving Park, and will erect several plants in addition to those erected in this city two or three years ago. R. H. Coombs, vice-president of the S. A. E., is now general manager of both companies.

EMPLOY DISTRIBUTERS

CHARLOTTE, N. C., Dec. 20—H. L. McClaren, president of the McLaren Rubber Co., Charlotte, manufacturers of McLaren J & D tires, has announced that McLaren tires for the coming year will be sold through distributors and dealers. The McLaren organization will have no branches.

DOUBLE PHARIS OUTPUT

NEWARK, O., Dec. 20—A contract has been made for the erection of a large addition to the plant of the Pharis Tire & Rubber Co., which has been in operation for about five years. An increase in the capital of the company from \$100,000 to \$1,000,000 has been authorized.

ENLARGE AVERY PLANT

MILWAUKEE, Dec. 22—The motor works of the Avery Co. of Peoria, Ill., located in West Allis, a suburb of Milwaukee, are being enlarged by the erection of a brick, steel and concrete addition, 40x208 ft., connecting the gray iron foundry with the main machine shop.

Current News of Factories**Notes of New Plants—Old Ones Enlarged****TO DOUBLE OUTPUT**

NEW YORK, Dec. 20—The Kankakee Automobile Co., of Kankakee, Ill., manufacturer of Kankakee Trucks, reports that the first of the recent additions to the plant will be occupied about Jan. 15. Double the present production is expected when the addition is operating.

HARVEY CO. TO BUILD

RACINE, WIS., Dec. 22—The Harvey Spring & Forging Co. has awarded contracts for the erection of a large manufacturing addition made necessary by the growth of demands upon its facilities by the automotive industries. The building will be of brick and steel, two stories, 100x200 ft., and with new machinery and other equipment will cost nearly \$150,000.

WILL BUILD ENGINES

MARION, IND., Dec. 22—With the completion of a new machine shop at the plant of the Indiana Truck Corp., the company will undertake the manufacture of engines on a large scale, for installation in its own trucks. Truck production will be greatly increased with the new addition.

START KNOX PLANT

MT. VERNON, O., Dec. 20—The contract for the erection of a \$170,000 factory building for the Knox Tire & Rubber Co., has been awarded to Columbus contractors and the work of construction will be started at once. It is hoped to have the factory completed by June 1 of next year.

INCREASES CAPITAL

HOWELL, MICH., Dec. 22—The Spencer-Smith Machine Co., in carrying out plans for production of 1,000,000 pistons in 1920, has increased its capitalization from \$100,000 to \$200,000, and a large expansion program is being outlined. The company supplies pistons to seventeen motor car companies and also is manufacturing a special lightweight piston for Ford cars.

FORM MALLEABLE CO.

DETROIT, Dec. 20—Governor Sleeper of Michigan, J. N. Klock of Benton Harbor, Mich., and a number of other Michigan men participated in the formation of the Muncie Malleable Co., which has taken over the Whitney Malleable Castings Co., at Muncie, Ind. The new company has a capitalization of \$1,000,000, and the deal for the purchase of the Whitney outfit involved in the neighborhood of \$550,000.

St. Louis Corp. to**Build Eagle Truck**

ST. LOUIS, Dec. 22—St. Louis is to have a new 2-ton truck. It will be called the Eagle, and will be manufactured by the Eagle Motor Truck Corp., a \$100,000 corporation, to sell at \$2,000. A factory is now being erected at 6150-64 Bartmer avenue, and it is expected to market the first truck by Mar. 1. The officers of the corporation are: T. R. Ayars, president; J. P. Reis, first vice-president; H. L. Yawitz, second vice-president; J. W. Hay, secretary, and R. E. Fitch, treasurer. Reis formerly operated the Reis Auto Repair Co., 6158 Bartmer avenue. He will be in charge of engineering and production. R. H. Ferguson, formerly with the B. F. Goodrich Rubber Co., is general sales-manager.

INCORPORATIONS

WILMINGTON, DEL., Dec. 20—The following corporations have been chartered under the laws of Delaware:

Locomobile Co., of Wilmington, with a capital of \$2,000, to deal in and with engines, motors. The incorporators are T. L. Croteau, P. B. Drew and H. E. Knox, all of Wilmington.

Lance Motor Sales Co. of Wilmington, with a capital of \$30,000, to manufacture motor vehicles of all kinds. The incorporators are T. L. Croteau, P. B. Drew and H. E. Knox, all of Wilmington.

Camden Auto Sales Corp., of Philadelphia, with a capital of \$1,150,000, to sell motor trucks, automobiles. The incorporators are F. R. Hansell, J. Vernon Pimm and E. M. MacFarland, all of Philadelphia.

The American Tire Distributing Co. of New York filed a certificate amending the charter so as to increase the capital from \$200,000 to \$5,000,000.

ENLARGE FACTORIES

TORONTO, Dec. 22—The Willys-Overland, Ltd., will greatly enlarge their Canadian plant here. The Toronto agency has been purchased by the company and will be run as a factory branch. Several extensions to the Russell Motor Car plants will be announced in the near future, as will also a mammoth subsidiary company now far advanced in organization.

PLAN BRANCH FACTORY

EAU CLAIRE, WIS., Dec. 22—It is reported that the Stinson Tractor Co. of Minneapolis, which maintains a branch factory at Superior, Wis., will locate a second branch plant here early in 1920, and may transfer its headquarters. The company is incorporated in Minnesota with \$500,000 capital. Eau Claire men have taken an interest. J. H. Ott, a prominent lumber manufacturer of Eau Claire, will act as general manager of the proposed new manufacturing branch, as well as supervise the Superior factory.

NEW HAYES OFFICIALS

DETROIT, Dec. 22—Charles Drum, formerly with Hayes Manufacturing Co., but now in charge of Buick Motor Body Co., will be factory manager of Hayes after Jan. 15. Harry Deering, with Hayes for several years, is to have charge of production in sheet metal plant starting Jan. 15.

A. T. Wieland, who previous to his connection with the Hayes Ionia Co. was in the body department of the Pierce Arrow Co., will be superintendent of the Hayes body plant. L. B. Griffin, formerly connected with the sales department, is now assistant to the president. Godfrey Strelinger, formerly connected with production, will take Griffin's place in the sales department.

NEW N. I. V. A. SECRETARY

CHICAGO, Dec. 20—H. J. Sameit has been appointed acting secretary of the National Implement and Vehicle Association, the appointment to take effect immediately. Sameit has been assistant to Secretary and General Manager E. W. McCullough for a number of years, and when the latter resigned last week, was appointed to succeed him.

CHANGES AT STANDARD

DETROIT, Dec. 19—Major Lewis T. Kalb, formerly assistant to J. G. Utz, chief engineer of Standard Parts Co., Cleveland, has been appointed assistant general manager of the Standard Parts Axle division, under D. K. Moore, manager. Kalb during the war was major, attached to the quartermaster corps.

C. S. Jay, cashier of the Indiana Truck Corp., Marion, Ind., has been promoted to assistant treasurer of the corporation.

Lewis P. Kalb has been named assistant manager of The Stan-Par Axle plants. Kalb is well known in S. A. E. circles. Since doffing the major's uniform he wore in 1918 he has been a member of the engineering staff of the Standard Parts organization.

E. H. Courtenay, formerly of the Hydraulic Pressed Steel Co., and Shuler Axle Co., has joined the Torbenson Axle Co., as sales representative.

W. R. Mason has been appointed New England district salesmanager of the Sanford Motor Truck Co., and he will make his headquarters in Boston. Hamilton Clive is appointed southern district salesmanager for the same company and will make his headquarters in Atlanta.

C. F. Rouze, assistant salesmanager of the General Motors Truck Co., Pontiac, Mich., has been promoted to head of the sales promotion department. M. J. Kates has been appointed assistant salesmanager.

**Men
of the Industry
Changes in Personnel
and Position**

H. S. NORTON CHANGES

CLEVELAND, Dec. 22—Announcement is made of the appointment of H. S. Norton as director of sales of the General Top Co. Norton is a veteran of the complete car trade and for ten years has been with the Packard forces, the past two years as vice-president and director of sales of the Packard-Cleveland Motor Company.

NAME NEW OFFICIALS

CLEVELAND, Dec. 20—The Torbensen Axle Co. of Cleveland has appointed J. D. Smith, formerly works manager for the Timken company, manufacturing manager of the Torbensen plant.

G. W. Veale, production supervisor at the Timken plant, is to be production superintendent for Torbensen.

G. W. Carlson, engineer for Timken, will assume the same title at the Torbensen works.

C. H. LeHuquet has been promoted to assistant salesmanager of the International India Rubber Corp., of South Bend, Ind., which company he had been representing in the southern district.

A. C. Cook has been named general salesmanager; L. K. Berry, domestic salesmanager, and Charles J. Stilwell, foreign salesmanager, of the Warner & Swasey Co., Cleveland.

W. E. Steinback, treasurer and general manager of the Eisemann Magneto Corp. since its organization in 1910, has resigned to engage in other business. Steinback was instrumental in building the Eisemann business to its present commanding position.

George D. Smith has been elected vice-president and a member of the board of directors of the Winther Motor Truck Co., Kenosha, Wis. Smith reorganized the sales, advertising and service departments and doubled the shipments for November. An export department has been organized in charge of Charles H. Meeker. C. T. Allen has been elected secretary of the company and H. D. Snyder has been appointed assistant general salesmanager.

Alfred C. Houser, until recently a member of the Chicago Tribune editorial department, has become manager of the advertising and sales promotion department of the Dashiell Motor Co., Chicago, distributor of Dodge cars.

NAMES NEW OFFICIAL

NORTH TONAWANDA, N. Y., Dec. 20—H. D. Wilson has been appointed vice-president of the Herschell-Spillman Motor Co., and will assist in the administration of its expansion program, which calls for an increase in production from 40 to 200 engines a day.

Before joining Herschell-Spillman, Wilson was salesmanager for the Bijur Motor Appliance Co., of Hoboken. He had previously served in the automobile business since 1902, being successively employed by the Olds Co., Packard Motor Car Co., Eisemann Magneto Co., and Ferro Machine & Foundry Co.

STEINBACK RESIGNS

NEW YORK, Dec. 20—W. E. Steinback, treasurer and general manager of the Eisemann Magneto Corp., Brooklyn, since its organization in January, 1910, has resigned to engage in other business. Steinback was instrumental in building the Eisemann business to its present position, and is well known to the trade. His new plans will be announced in the near future.

L. D. Robertson has resigned as general manager of the Packard Detroit retail branch and has become a member of the firm of Brown, Robertson & Gilray, Inc., which is to be Packard distributor in Buffalo.

J. Zagora has resigned as designing and production engineer of the Anderson Motor Co., Rock Hill, S. C., and has established a plant for the manufacture of automotive parts and smaller assemblies, under the name of J. Zagora Manufacturing Co.

J. E. De Long has been appointed motor engineer by the Indiana Truck Corp., Marion, Ind. The Indiana corporation recently acquired the Rutenber Motors, with which De Long was connected as engineer. During the war De Long served in the A. E. F., where he helped organize the first U. S. Motorized Ammunition Train, and remained with the organization during hostilities.

J. A. Tarkington, who retires Jan. 1 as general superintendent and consulting engineer of the Kissel Motor Car Co., Hartford, Wis., was presented with a Howard watch by the employees of the Kissel company. Tarkington becomes managing head of the new Tarkington Motor Co., of Rockford, Ill., which is engaging in the manufacture of the Tarkington passenger car and motor truck early during the coming year.

Paul F. Lum has been appointed manager of the Autocar Sales & Service Co., in Washington, D. C., succeeding A. B. Cummer, who goes to the home office at Ardmore, Pa., to take charge of service. Cummer and Lum had been manager and assistant at the Washington branch since its opening two years ago.

Calendar

SHOWS

January — New York, International Automobile Mfrs.' Congress.
 Jan. 3-10 — New York, N. Y. Grand Central Palace, National Automobile Chamber of Commerce. S. A. Miles, Manager.
 Jan. 3-10 — New York City. Eighth Coast Artillery Armory, commercial cars and accessories.
 Jan. 8 — Chicago. Airplanes. Manufacturers' Aircraft Association. Congress Hotel.
 Jan. 12-17 — Dayton, O. Annual Automobile Show. Borchers Auto Co.'s new building. Dayton Auto Trade Assn. H. C. Phelps, Director, and B. J. Borchers, Chairman.
 Jan. 17-21 — Cleveland. Nineteenth Annual Automobile Show. Cleveland Automobile Mfrs.' and Dealers' Assn. Wigmore Coliseum.
 Jan. 17-24 — Hartford, Conn. Shows, State Armory. Annual Exhibition. Arthur Fifoot, Manager.
 Jan. 18-24 — Worcester, Mass. Automobile Show. Worcester Automobile Association.
 Jan. 19-25 — Oakland, Cal. Annual Motor Show. Alameda County Automobile Trade Association. Civic Auditorium. Robert W. Martland, Manager.
 Jan. 19-25 — Milwaukee, Wis., Auditorium. Annual Motor Exhibition. Milwaukee Automobile Dealers' Inc.
 Jan. 22-24 — Lancaster, O. Annual Automobile Show. Fairfield County Auto Trades Assn. Sherman Memorial. W. H. Payne, Manager.
 Jan. 24-31 — Chicago, Ill. Coliseum. Cars: Drexel Pavilion, National Automobile Chamber of Commerce. S. A. Miles, Manager.
 Jan. 24-31 — Chicago. International Amphitheater, Commercial cars and accessories.
 Jan. 31-Feb. 6 — Kansas City, Mo. Annual exhibition. Overland Bldg. E. A. Peak, Manager.

Jan. 31-Feb. 7 — Minneapolis, Minn. Twin City Automobile Truck, Tractor and Industrial Show, Overland Bldg.
 February — Chicago. International Automobile Mfrs.' Congress.
 February — Deadwood, S. D. Annual Show. Deadwood Business Club. F. R. Baldwin, Manager.
 Feb. 2-7 — Toledo, Ohio. Annual Automobile Show. Terminal Auditorium.
 Feb. 3-7 — Wilmington, Del. Automobile Show. Hotel duPont.
 Feb. 3-7 — Baltimore, Md. Automobile Show. Baltimore Automobile Dealers' Assn. Fifth Regiment Armory. John C. O'Brien, Manager.
 Feb. 9-13 — Charlotte, N. C. Automobile Show. Charlotte Automotive Trade Association. Lee Folger, Chairman. Show Committee.
 Feb. 9-14 — Cedar Rapids, Ia. Annual Automobile Show. Linn County Motor Trades Bureau. Auditorium. W. J. Hutchings, Chairman, and H. M. Davis, Secretary.
 Feb. 9-14 — Poughkeepsie, N. Y. Annual Automobile Show. Poughkeepsie Auto Club. Armory. George A. Coleman, Manager.
 Feb. 9-14 — Salt Lake City. Annual Automobile Show. W. D. Rishel, Manager.
 Feb. 9-14 — Nashville, Tenn. Nashville Automobile Trade Association.
 Feb. 10-15 — Quincy, Ill. Annual Automobile Show.
 Feb. 14-22 — San Antonio, Tex. Automobile Show. San Antonio Automobile Trade Assn. W. A. Williamson, Manager.
 Feb. 16-21 — Des Moines, Ia. Annual Automobile Show. Des Moines Automobile Dealers' Assn. Ford Factory. Dean Schoeler and C. G. Van Vliet, managing.
 Feb. 21-28 — San Francisco. Fourth Annual Automobile Show. Exposition Auditorium. Motor Car Dealers' Assn. G. A. Wahlgreen, Manager.

Feb. 21-28 — Louisville, Ky. Twelfth annual exhibition. Louisville Automobile Dealers' Assn. First Regiment Armory.
 Feb. 22-28 — Ottawa, Ontario. Motor Show.
 Feb. 23-28 — Grand Rapids, Mich. Motor Car Show. Furniture Exposition Building. M. D. Elgin, Manager.
 Feb. 23-28 — Duluth, Minn. Automobile Show. Duluth Auto Trades Assn. W. F. Daly, Director.
 Mar. 1-6 — Springfield, Mass. Annual Automobile Show. Auditorium. Springfield Automotive Dealers' Assn. Robert H. Clark, Manager.
 Mar. 1-6 — St. Joseph, Mo. Annual Automobile Show. St. Joseph Automobile Show Assn. Auditorium. John Albus, Manager.
 Mar. 1-6 — Grand Rapids, Mich. Truck Show. Furniture Exposition Bldg. M. D. Elgin, Manager.
 March 1-7 — Springfield, Mass. Annual Automobile Show. Springfield Automotive Dealers' Assn. Harry Stacy, Secretary.
 Mar. 7-13 — Muskegon, Mich. Automobile Show. Muskegon Auto Business Men's Assn. J. C. Fowler, Manager.
 Mar. 10-13 — Lebanon, Pa. Annual Motor Show. Automotive Trade Association of Lebanon. James Furniture St' Bldg. J. Paul Enek, Manager.
 March 12-20 — Boston, Mass. Annual Automobile Show. Mechanics' Building.
 Mar. 15-20 — Great Falls, Mont. Automobile Show. Montana Automobile Distributors' Association.
 Mar. 20-27 — Trenton, N. J. Annual Automobile Show. Armory. Trenton Automobile Dealers' Assn. John L. Brock, Manager.

FOREIGN SHOWS
 January — Glasgow, Scotland. Scottish Motor Exhibition.
 February — Manchester, England. North of England Motor Exhibition.

Feb. 22-March 6 — Birmingham, Eng. British Industries Fair.
 March — London, Eng. Motor Boat Marine and Stationary Engine Exhibition.
 March — Adelaide, Australia. All Australian Exhibition of motor vehicles, airplanes, engines and automotive equipment.
 March 1-15 — Lyons, France. Automotive Products, Lyons Industrial Fair.
 April or May — London, Eng. Commercial Vehicle Exhibition. Olympia.
 April 3-May 4 — Buenos Aires. Exposition of U. S. manufacturers.

TRACTOR SHOWS

Feb. 2-14 — Wichita, Kan. Tractor and Farm Machinery Forum. Wichita Thresher-Tractor Club.
 Feb. 16-21 — Kansas City, Mo. Fifth Annual Kansas City Tractor Club. Guy H. Hall, Manufacturer.

CONTESTS

August, 1920 — Paris, France. Grand Prix Race. Sporting Commission Automobile Club of France.
 June, 1920 — Omaha, Neb., Reliability Truck Tour.

CONVENTIONS

Feb. 9-13 — Louisville, Ky. Seventeenth Annual Convention American Road Builders' Assn. Tenth American Good Roads Congress, and Eleventh National Good Roads Show.
 May 13-20, 1920 — San Francisco. Seventh National Foreign Trade Convention.

S. A. E. MEETINGS

Jan. 6-8 — New York. Annual Meeting.
 Jan. 13 — Chicago. Aeronautic Meeting, auspices Mid-West Section.
 Jan. 28 — Chicago. Truck and Tractor Meeting. Hotel La Salle.
 Feb. 12 — Kansas City, Mo. Tractor Dinner, Hotel Baltimore.

Service Men Meet

During Show Week

NEW YORK, Dec. 23 — One of the attractions of show week will be the convention and banquet of the combined Automotive Service Associations of New York and Newark which is to be held at 2 p. m. January 5, at the Automobile Club of America.

Al Reeves, general manager of the National Automobile Chamber of Commerce, will open the convention. Important papers on service topics will be presented by men well known to the industry. Major Osmun, of the Motor Transport Corps, will tell how the automotive industry can cooperate with the army to have transport facilities in perfect readiness for any emergency, and Prof. Favary, head of the automotive laboratories at Cooper Union, will tell of the benefits to be derived from technical knowledge. Dr. Walter Hervey, of the Board of Examiners of the New York Public Schools, will speak on education and there will be papers by members of the two associations. The chairman will be Ralph C. Rognon, president of the New York association.

WANT CAR CATALOGS

INDIANAPOLIS, Dec. 22 — Catalogs of American built automobiles together with terms of export and all possible information as to prices and other features are sought by the Koyo Co., importers and exporters of Seoul, Korea, according to a letter recently received by the Gibson Co., Indianapolis, with whom the Koyo company has been trading.

DULUTH SHOW IN FEBRUARY

DULUTH, MINN., Dec. 22 — Passenger cars and trucks will be combined at the annual automobile show of the Duluth Auto Trades Association, to be held in the armory, from Feb. 23 to 28. W. F. Daly will be director of the show.

INDIA DISTRIBUTER NAMED

DETROIT, Dec. 22 — The Columbia Motors Co. has closed a contract with Ram Naick & Co., of Madras, India, for distribution of the Detroit product in that country, where it is said the American automobile rapidly is becoming popular. Naick's representative who closed the contract for Columbia distribution, says his firm dates back to the palanquin

period, having been organized centuries ago to build the wheelless vehicle in which passengers were carried about on the shoulders of stalwart natives. Later the company built chariots and then progressed to two-wheel bullock carts and finally to the four-wheeled vehicles similar to those in use in America.

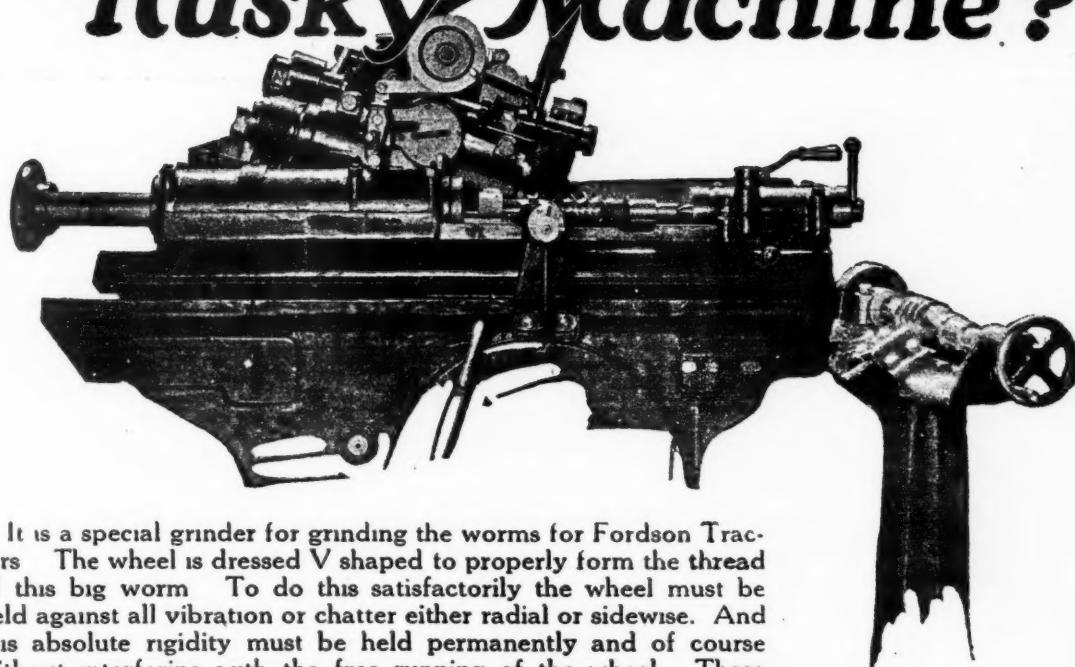
NEW SHOW QUARTERS

FARGO, N. D., Dec. 22 — The annual automobile show of the Fargo-Moorhead Automotive Trade Association will be held in the Barry building, from Feb. 10 to 13, under the direction of H. L. Wilson. The Berry building is a recently constructed fireproof garage, three stories and basement.

TIRE PLANT ENLARGED

SOUTH BEND, Dec. 20 — The International India Rubber Corp. has broken ground for a factory addition for the installation of a line of three new mixing mills and one large size calendar. Three new vulcanizers are to be added also. It is expected that the factory capacity will be 800 tires and tubes a day.

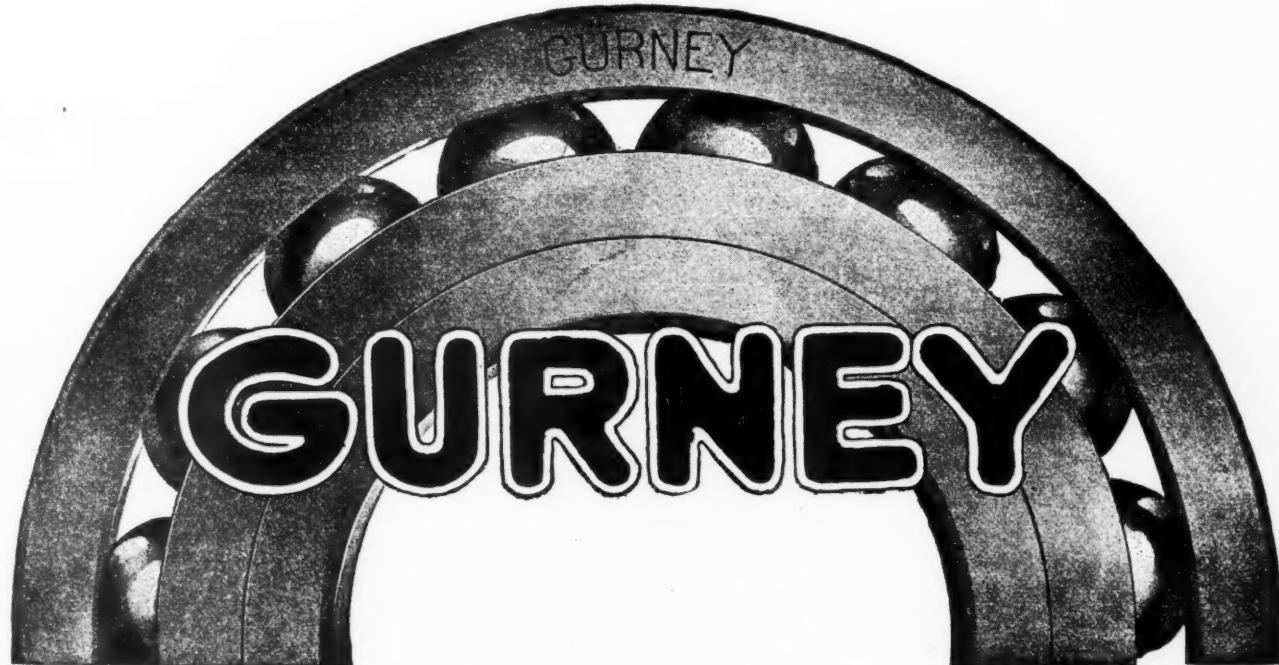
What Is This Husky Machine?

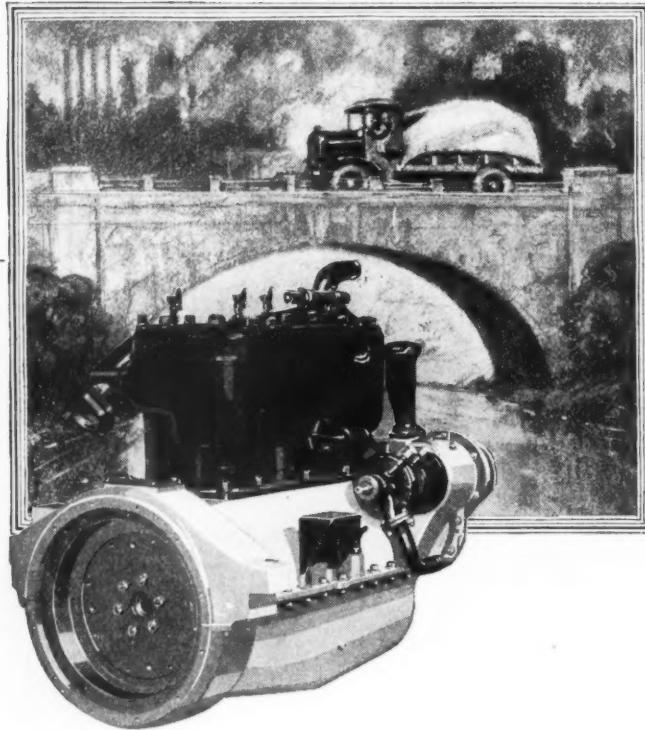


It is a special grinder for grinding the worms for Fordson Tractors. The wheel is dressed V shaped to properly form the thread of this big worm. To do this satisfactorily the wheel must be held against all vibration or chatter either radial or sidewise. And this absolute rigidity must be held permanently and of course without interfering with the free running of the wheel. These worms must be ground smooth and true and they must be produced in quantity in the true Ford fashion.

Accordingly Mr Ford does the logical thing to make sure of these results, mounts the spindles of these machines on Gurney Radio-Thrust Bearings.

GURNEY BALL BEARING CO.
CONRAD PATENT LICENSEE
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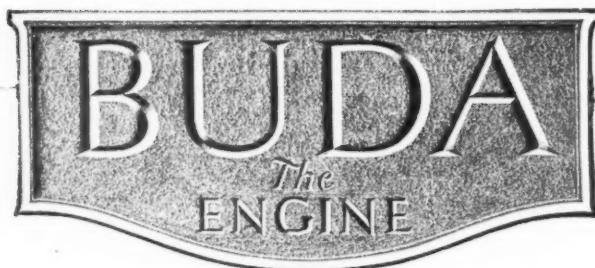
It has been the constant aim of The Buda Company to build for high quality rather than huge production—to produce an engine able to perform, to the most gratifying degree, the work for which it is intended.

Quality performance, such as rendered by the Buda engine, is recognized more and more as the vital factor contributing to the maximum measure of truck, tractor or passenger car service satisfaction.

Because the ability of the Buda engine to deliver punctual and profitable power has been so thoroughly demonstrated in every field of service, Buda-equipped products enjoy a remarkably receptive market.

Sustained quality performance is the solid foundation upon which rests the ever-increasing prestige of the Buda engine among automotive vehicle manufacturers, dealers, and users.

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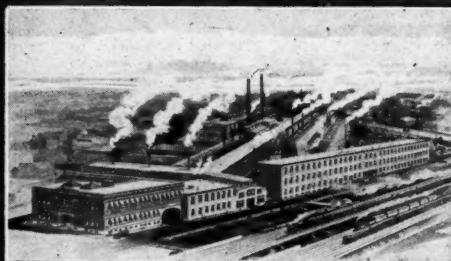


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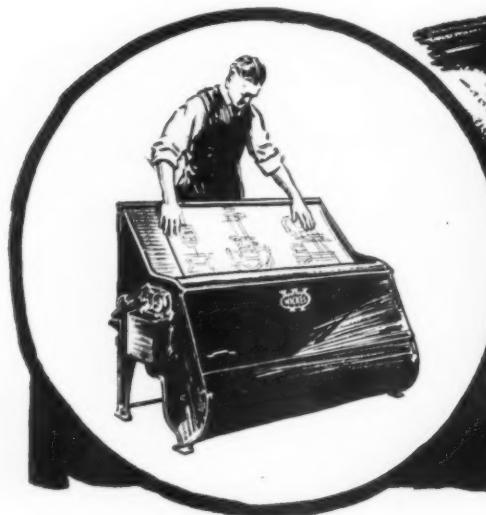
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M



OWING to the difficulties of keeping the records of this publication in New York City and doing the printing in Chicago, it is impractical that we include in this issue the index. This, as all readers know, has been the custom for several years. We realize that the index is valuable to many of our readers and we do not wish to deprive any reader of this convenience.

The index for the last six months will be printed in separate form as quickly as the record department can complete its work. This index will be sent to all readers upon request. So we ask that any reader wishing to bind or otherwise include the index in his file of the last six months, write at once to the editorial department of AUTOMOTIVE INDUSTRIES asking for the index and the request will be complied with.

We regret any change in the established custom but this is one of the difficulties that could not be overcome in working out the problems arising from the recent printers' strike.



Schatz "UNIVERSAL" *Annular* BALL BEARING QUALITY means *Greater Carrying Capacity and Higher Efficiency*

**3 Area
Contact**

The Three Area Contact distinguishes this from the ordinary bearing. The balls obtain two areas of contact in the outer race at a constant angle to the third area of contact in the deep race of the cone. An important contribution to SCHATZ "UNIVERSAL" QUALITY!

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Design**

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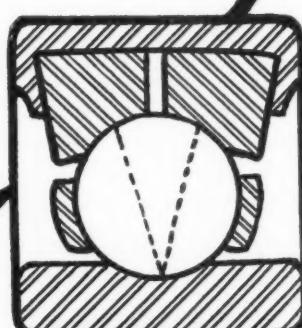
**Excellent
Workmanship**

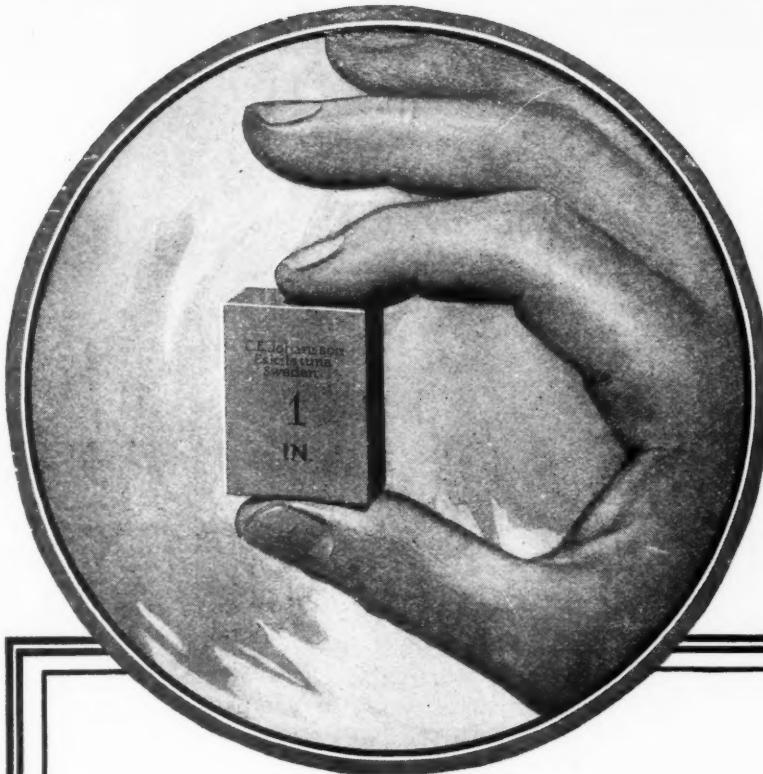
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Johansson FINISH

ACCURATE gaging depends in a large measure on the final finish of the gage. The surface must be even and flat to an unusual degree, else the tiny hills of the wearing plane will be quickly worn away and the thickness of the gage appreciably reduced. The surfaces must be parallel, and the steel must have that peculiar toughness that affords long use with the minimum of wear. Finally the seasoning must be such that

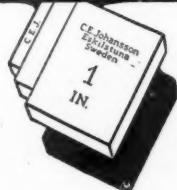
tensions are not set up to alter the delicate accuracy.

Some fifteen years were required to solve these problems. Today the man who buys Johansson Gages can do so with the confidence that unwearying experiments and long-time tests have established both the finish and the accuracy.

Let us send you details of standard sets, plug gages, snap gages and other Johansson tools.

C. E. JOHANSSON, INC.
Poughkeepsie, N. Y.

Johansson ACCURACY





Long Life in a Bearing Bronze

*is not secured by this or any
other chemical specification*

NOR will physical tests, in combination with chemical analyses, predetermine the service life of a bearing bronze.

The sure way to get a dependable, long-life, wear-resisting bronze is to do as Baldwin Locomotive, General Electric, Curtiss Aeroplane, Locomobile and hundreds of other big industrial and automotive manufacturers do and that is—specify Non-Gran on your prints. Then you know that you will get a bearing bronze of proved dependability made by bearing bronze specialists who have made nothing else for over ten years—a bearing bronze of unvarying uniformity, free from flaws, sand holes, air or gas pockets—a bronze that will give your machines longer service life by postponing bearing renewals and overhauling dates.

Bear this in mind: You cannot "write" long life into a bearing by means of a specification. But, by writing "NON-GRAN" on your blue prints you get the long life Non-Gran insures—not once but every time.

We'll gladly send you copies of the Non-Gran booklets and a list of prominent manufacturers using Non-Gran. Address:

AMERICAN BRONZE CORPORATION
BERWYN

DISTRICT OFFICES

343 Tremont Bldg., Boston, Mass. 3010 Woolworth Bldg., New York, N. Y.
404 People's Gas Bldg., Chicago, Ill. 340 Leader-New Bldg., Cleveland, O.
Pacific Coast Allied Industries, Inc. - - - 279 Minna St., San Francisco, Cal.
340 Azusa St., Los Angeles, Cal. 1252 1st Avenue, So., Seattle, Wash.



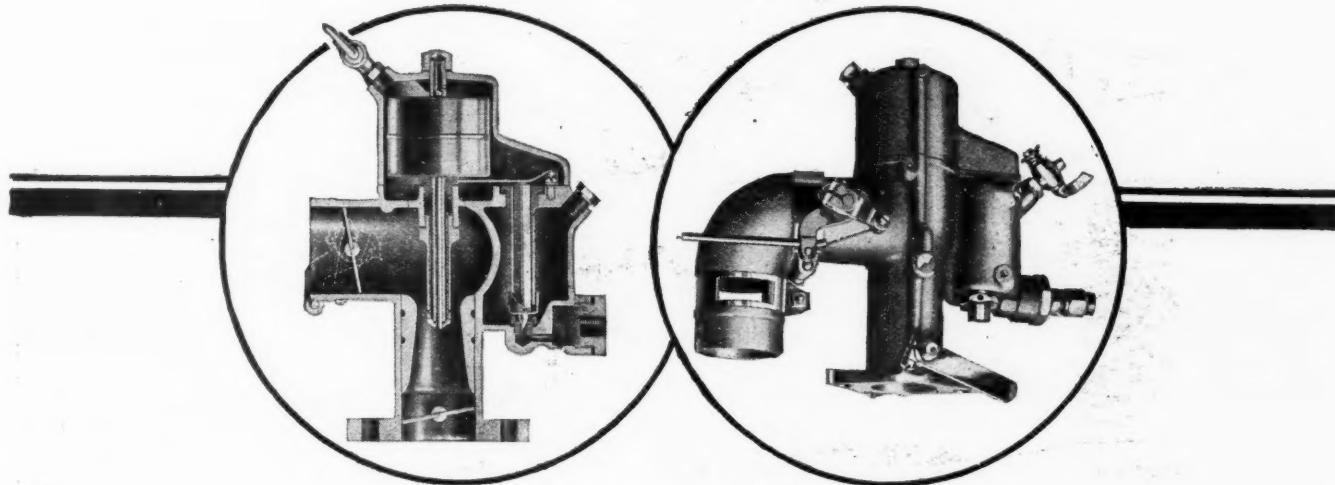
American Distributors

Cutter & Wood Supply Co., 68 Pearl St., Boston, Mass.
Peter A. Frasse Co., Inc., 417 Canal St., New York City.
Samuel Harris & Co., 114 North Clinton St., Chicago, Ill.
C. S. Mersick & Co., 274 State St., New Haven, Conn.
Sidney H. Koby Company, Rochester, N. Y.
Root, Neal & Company, 178 Main St., Buffalo, N. Y.
F. E. Satterlee Co., 118 Washington Ave., North Minneapolis, Minn.
Strong, Carlisle & Hammond Co., 236 Frankfort Ave., N. W., Cleveland, O.
Pittsburgh Gage & Supply Company, Pittsburgh, Pa.
Boyer-Campbell Company, Detroit, Mich.
Oliver H. Van Horn Co., Inc., New Orleans, La.
W. J. Holliday & Co., Indianapolis, Ind.
The Wirthlin-Manz Company, 512-520 West Third Street, Cincinnati, Ohio.
Colcord-Wright Machinery and Supply Company, 1223-1229 North Broadway, St. Louis, Mo.
The M. I. Wilcox Company, 210-216 Water St., Toledo, O.

Foreign Distributors

Foreign Dept., Automotive Products Corporation,
3010 Woolworth Bldg., New York, N. Y.
Stanley J. Watson
Sheen Road, Richmond, London, England.
Aktiebolaget Galco
18 Norra Bantorget, Stockholm, Sweden.
Cycle Motor Trade Supply Co., Capetown and Durban.
Henderson & Co., Johannesburg, South Africa.
John O'Neill Pty., Ltd., Sidney, Australia.
Sociedad de L. Villamil and Co., Porto Rico.
Simson and Nielson, Copenhagen, Denmark.

The Rayfield Model O Plain Tube Carburetor Will Make Your Truck Perform Better



The Rayfield Model O Plain Tube Carburetor has proved in the truck field equal to the high standards set by other Rayfield models on passenger cars.

On both light and heavy trucks Model O has demonstrated the flexibility and power it gives to the motor.

This truck carburetor is of concentric float construction with a plain tube. The fulcrum lever type of float mechanism provides for a

positive method of controlling the flow of gasoline into the carburetor.

We are now in position to furnish Model O in quantities to truck manufacturers for standard equipment.

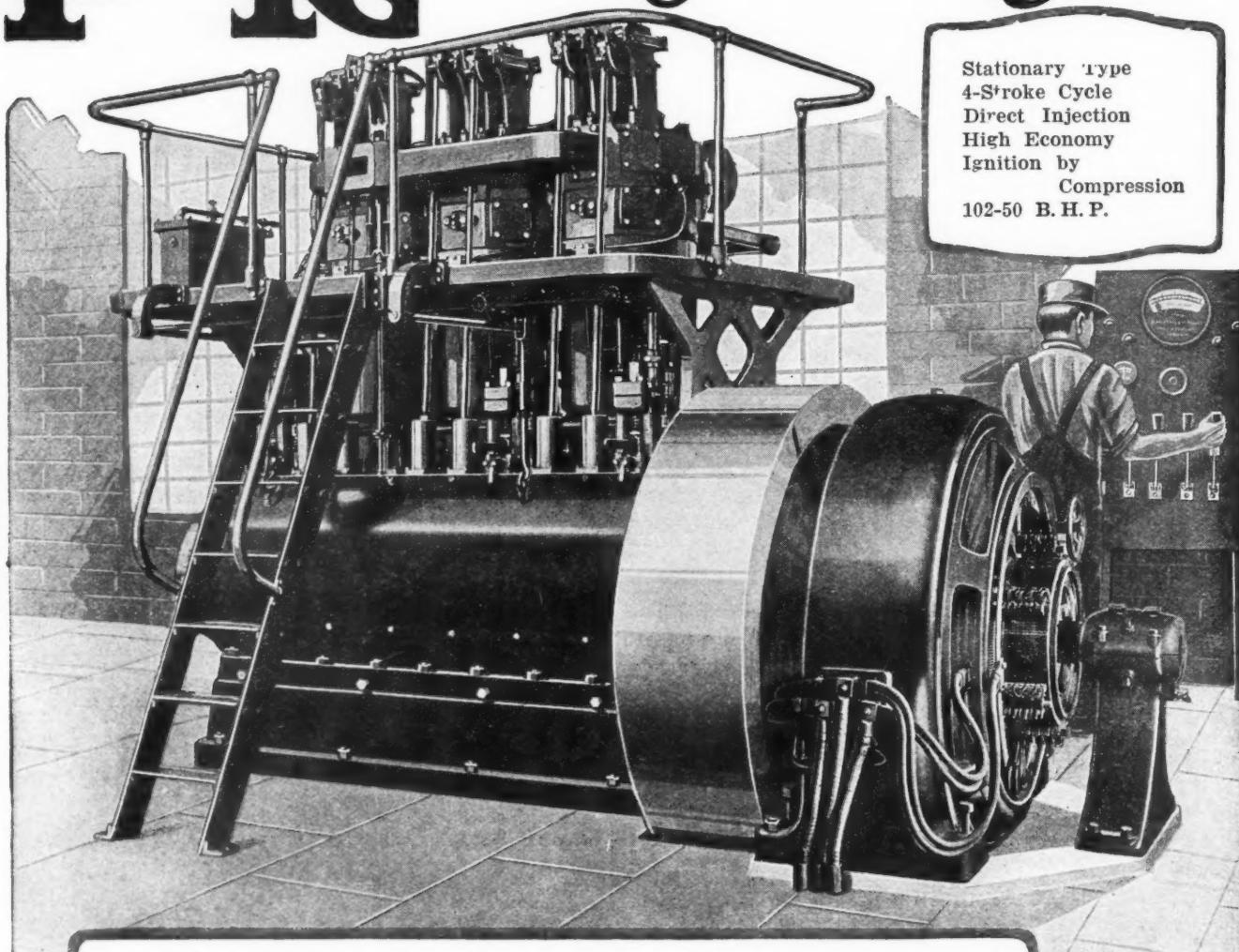
Samples for testing purposes will be sent to responsible truck manufacturers. Write for them, and for full details of construction and operation.

BENEKE & KROPF MANUFACTURING CO.

21st and Rockwell Streets, Chicago, Illinois

RAYFIELD
CARBURETORS

P-R Heavy-oil Engines



Lowest Cost per Horse Power

There is but one measure of the efficiency of the complete power plant and that is *the cost per unit of usable power*.

The P-R engine converts the fuel *directly* into power; no boiler plant is used. And it has a *remarkably high fuel economy*.

All the power produced is available for useful work; the P-R engine requires *no auxiliaries*. This alone represents a large saving.

And the P-R engine is not only mechanically efficient, but has many remarkable features which make it easy to take care of. The P-R engine produces each unit of *useful work at lowest cost*.

Write today for further information.

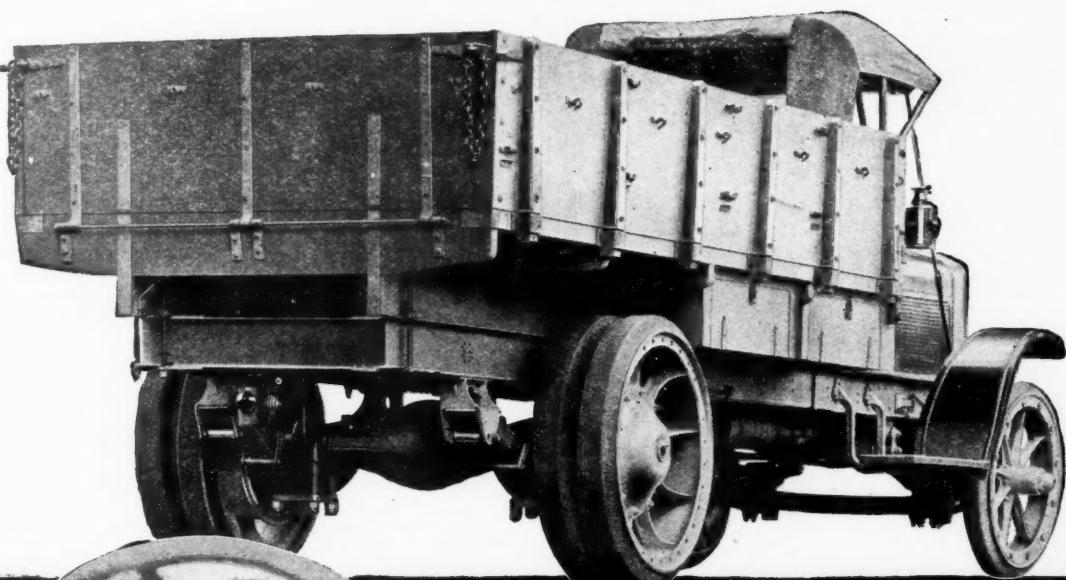
INGERSOLL-RAND COMPANY

11 Broadway, New York

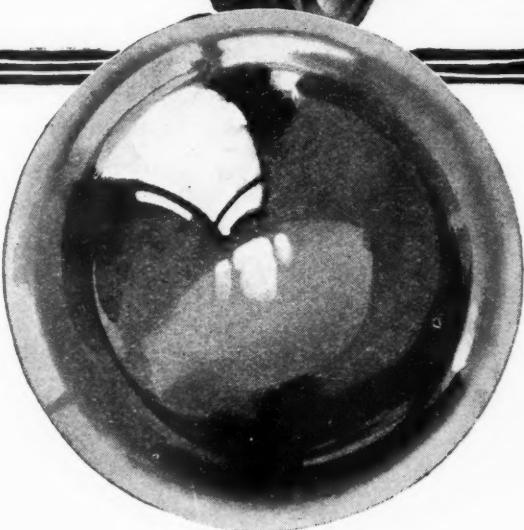
Offices the World Over

165 Q. Victoria St., London

1-SOE



The White Heavy-Duty Truck

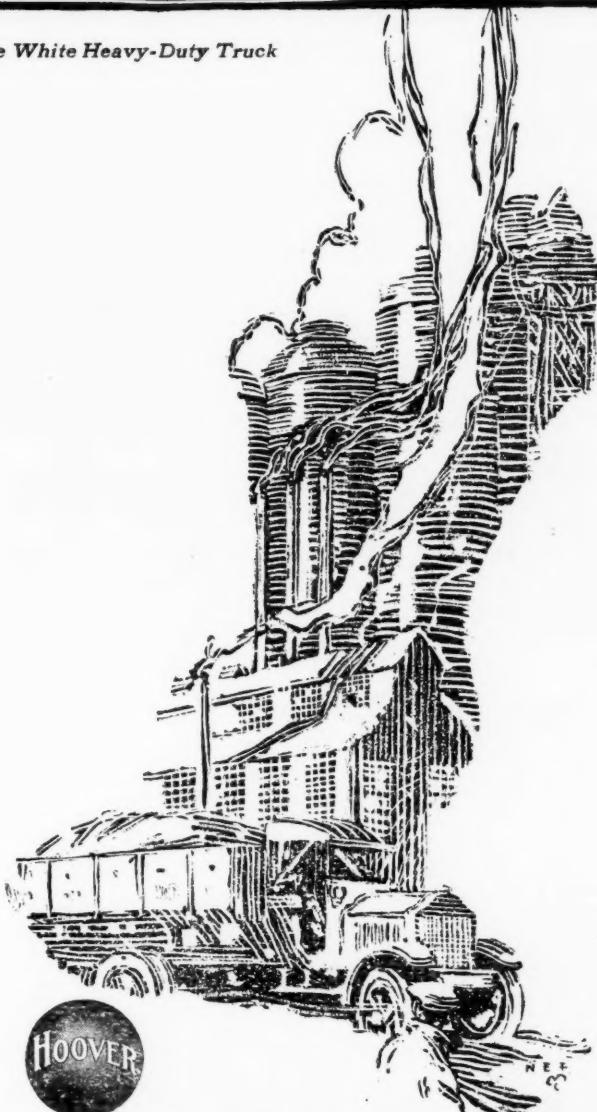


The Motor Truck must endure the strain and friction caused by rough roads and heavy loads. The stamina to continually resist these shocks and furnish the utmost power is provided, to a great extent, by ball bearings.

The perfect roundness and velvety smoothness of Hoover Steel Balls, used in ball bearings, help to cushion the road shocks and absorb the friction which causes loss of power and shortens the life of the unit.

They are used in the ball bearings that are in a multitude of the nation's most faithful servants.

HOOVER STEEL BALL COMPANY
ANN ARBOR MICHIGAN



HOOVER
STEEL BALLS



-and for Milling Crank Case Cap Seats

**Milwaukee
Milling
Machines**

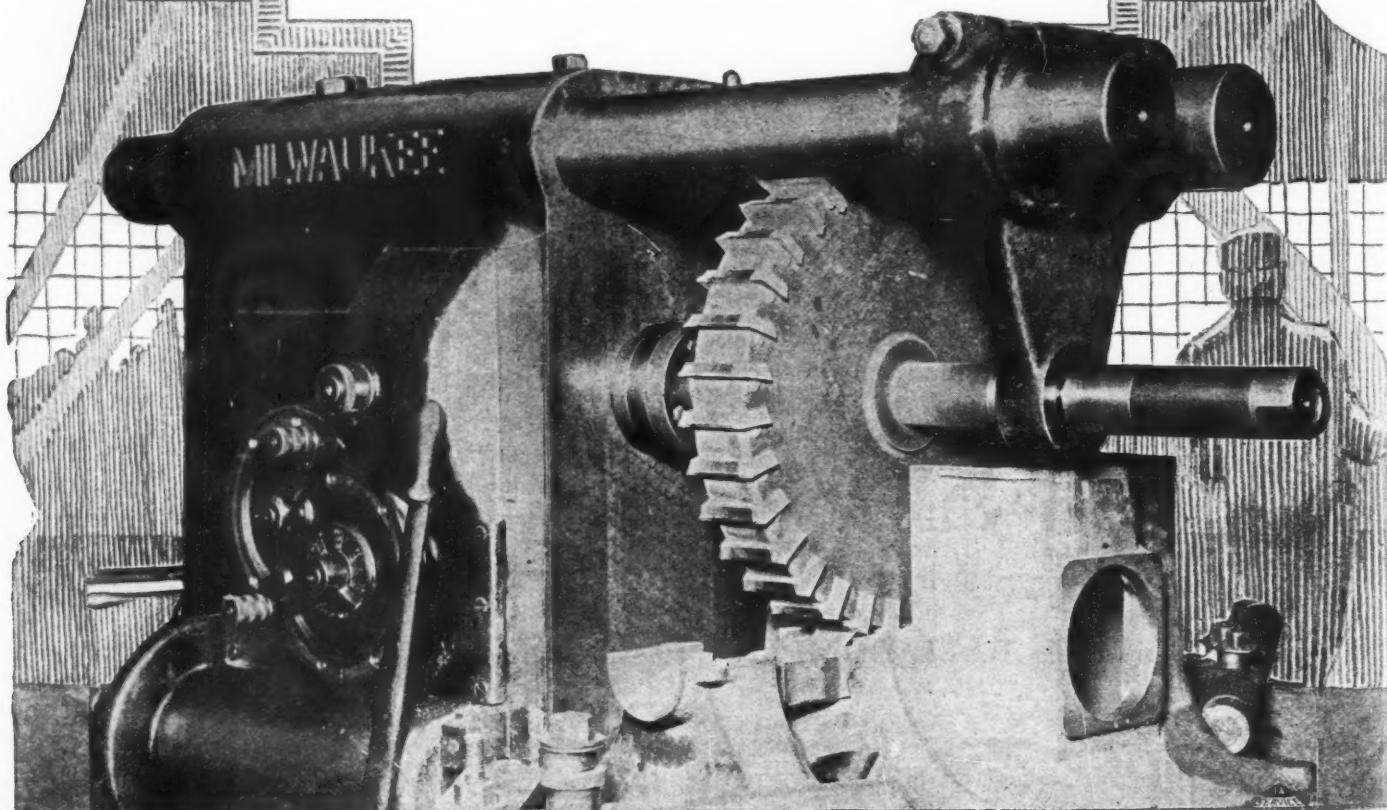
MILWAUKEE MILLING MACHINES lend uttermost assurance—confidence that a maximum production, no matter what the requirements may be, will be secured without interruption.

And the positive knowledge that no job is too hard—that no precision is greater—that continuous service will be performed—is an overwhelming feature which makes MILWAUKEE MILLING MACHINES the first choice—always.

The high esteem, which is extended to MILWAUKEE MILLING MACHINES is no greater than the conscientious effort and unhampered willingness of the manufacturers to furnish a design and quality of construction—unparalleled.

A No. 3B Plain Milwaukee Milling Machine

Using a Cutter 18" in Diameter— $3\frac{1}{8}$ " Face



KEARNEY & TRECKER Co. Milwaukee, Wis. U.S.A.

Airco Oxygen and Acetylene Service

Pure oxygen, pure acetylene—and a distributing station near every Airco user.

Where Airco Distributing Stations are located:

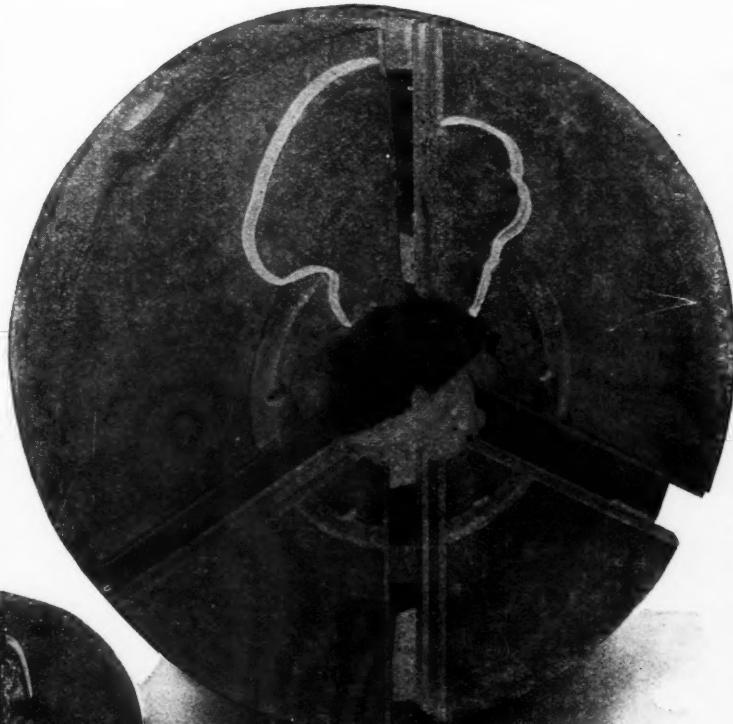
- *ATLANTA, GA.
- BALTIMORE, MD.
- *BOSTON, MASS.
- BRIDGEPORT, CONN.
- BRONX, N. Y.
- BROOKLYN, N. Y.
- *BUFFALO, N. Y.
- CAMDEN, N. J.
- *CHICAGO, ILL.
- CINCINNATI, O.
- *CLEVELAND, O.
- COATESVILLE, PA.
- COLUMBUS, O.
- DEFIANCE, O.
- DES MOINES, IOWA.
- *DETROIT, MICH.
- DORCHESTER, MASS.
- DULUTH, MINN.
- EAST CHICAGO, IND.
- EAST ST. LOUIS, ILL.
- *EMERYVILLE, CALIF.
- FORT WAYNE, IND.
- GRAND RAPIDS, MICH.
- INDIANAPOLIS, IND.
- JERSEY CITY, N. J.
- JOHNSTOWN, PA.
- KANSAS CITY, MO.
- LOUISVILLE, KY.
- MADISON, ILL.
- MILWAUKEE, WIS.
- *MINNEAPOLIS, MINN.
- NASHVILLE, TENN.
- NEW HAVEN, CONN.
- *NEW YORK CITY.
- NORFOLK, VA.
- OKLAHOMA CITY, OKLA.
- OMAHA, NEB.
- PATERSON, N. J.
- PEORIA, ILL.
- *PHILADELPHIA, PA.
- *PITTSBURGH, PA.
- *RICHMOND, VA.
- SAN FRANCISCO, CALIF.
- SEATTLE, WASH.
- SHARON, PA.
- SO. BETHLEHEM, PA.
- SO. BOSTON, MASS.
- SPRINGFIELD, O.
- *ST. LOUIS, MO.
- TACOMA, WASH.
- TERRE HAUTE, IND.
- TOLEDO, O.
- VENICE, ILL.
- WARREN, O.
- WILKES-BARRE, PA.

*District offices. Communications should be addressed to nearest District office.

The lower picture shows a fractured chuck before being repaired with the Airco Welding Torch.

The upper picture shows the same chuck welded and ready for machining.

**AIRCO
PRODUCTS**
Oxygen
Acetylene
Welding and Cutting
Apparatus and Supplies
Acetylene Generators
Calcium Carbide
Nitrogen



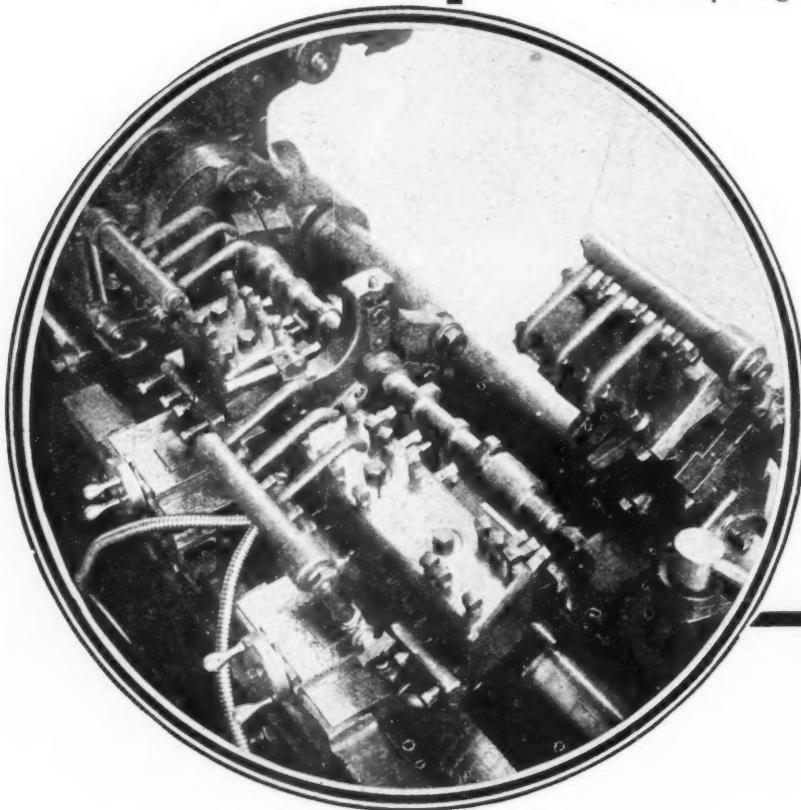
Air Reduction Company, Inc.

NEW YORK, N. Y.

AIRCO SERVICE—A DISTRIBUTING STATION NEAR EVERY AIRCO USER

FAY AUTOMATIC LATHE

The
FAY WAY
of
MACHINING
CAM SHAFTS



*Machining the cam
shaft of a well
known 4-cylinder
automobile engine
—the FAY WAY.*

**Increases Output per Machine—
Reduces Labor Costs—
Eases Up the Day's Work
for the Operator**

THE REASON — instead of making one cut at a time about half of the many small cuts are made at one time by a number of tools —automatically—the remaining surfaces being turned on a similarly set up second machine. Both are handled by one operator whose actual work is limited to loading and unloading the work and attending to the sharpening of tools.

THE METHOD—all the tool motions are automatic. The front turning tools feed in between the shoulders, turn to proper length and withdraw again —automatically. The back tool holder feeds down to square up the shoulders and returns. The machine stops itself. A second operation on a similar machine completes the remaining cuts.

The Fay Lathe is completely illustrated and described in the catalog of the same name which we send on request.

JONES & LAMSON MACHINE CO.
SPRINGFIELD

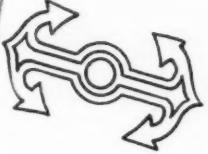
VERMONT

503 Market St., San Francisco, Cal. London, E. C., France, Spain and Belgium; F. Auberty & Co.
91 Rue de Maubeuge, Paris. Holland, Rotterdam, Japan, Korea, etc.; Mitsui & Co., Ltd., Tokio. Australia.
554 Collins St., Melbourne.

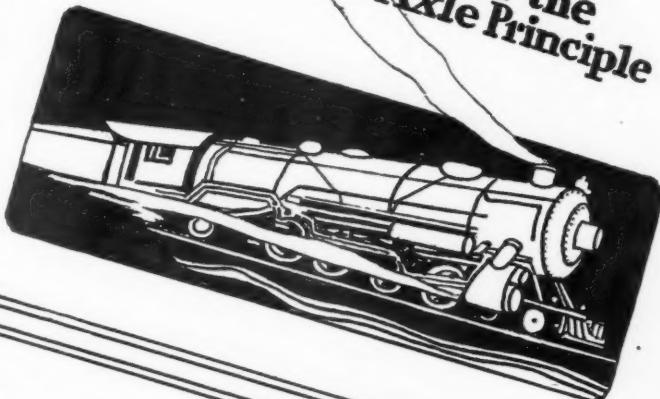




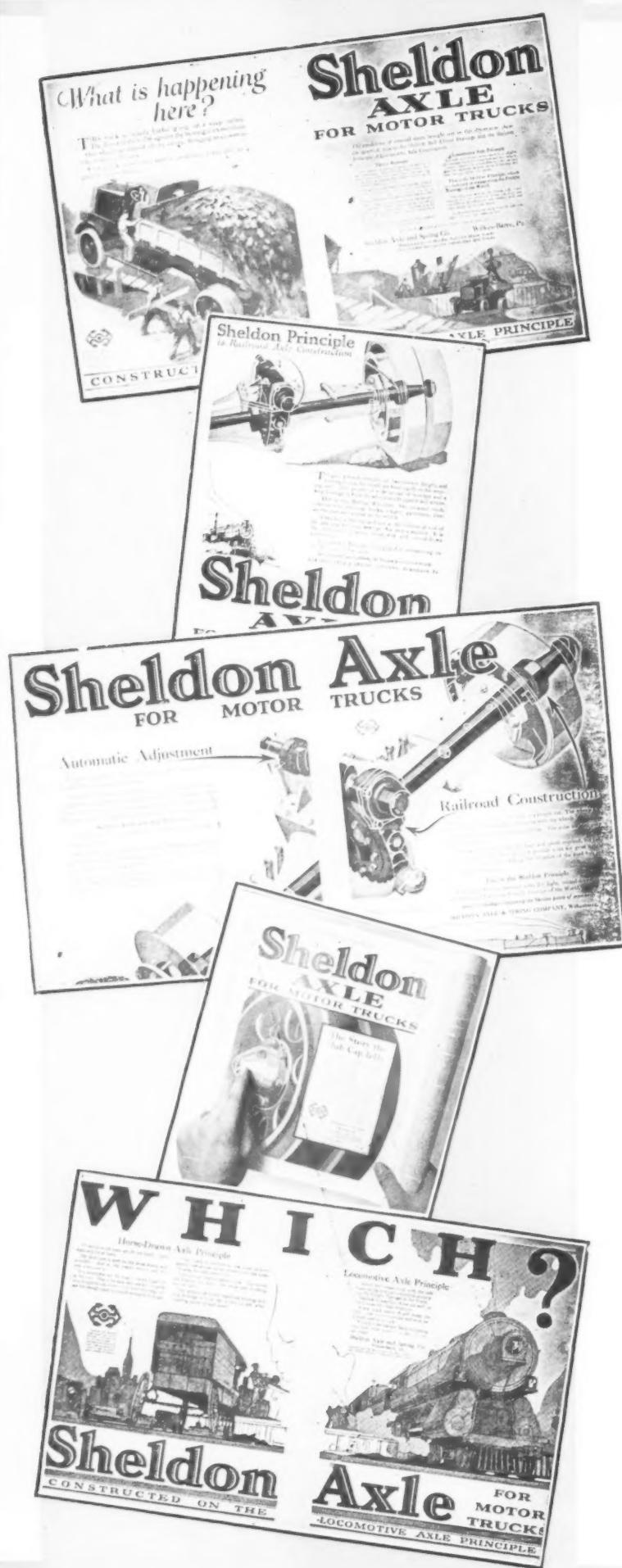
Sheldon WORM DRIVE Axles



*Constructed on the
Locomotive Axle Principle*



This new booklet just off the press contains information about the Sheldon Locomotive Axle principle of construction which every truck dealer and user should have. Mailed free upon request.



SHELDON'S INFLUENCE

To win first place in public sentiment, not as a whim of popular prejudice, but as an enlightened judgment, is the aim of Sheldon advertising, for the kind of favor that springs from knowledge is more enduring than that which is based merely on highly colored representation.

Therefore, Sheldon is putting constructive thought into its advertising. Its copy is informative—educational. It is teaching a valuable lesson to the great mass of technically uninformed truck users.

How many truck buyers have had an automotive engineering training? What have they really *known* about truck axles, in the past? Is it not true that they have had to take the truck builders' claims on faith?

Sheldon advertising is giving them some important sci-

ON THE TRUCK BUYER

tific truths, in language they can understand. It explains the fundamental reasons for the Sheldon method of construction. It tells the prospective owner what to *look for*—and *why*.

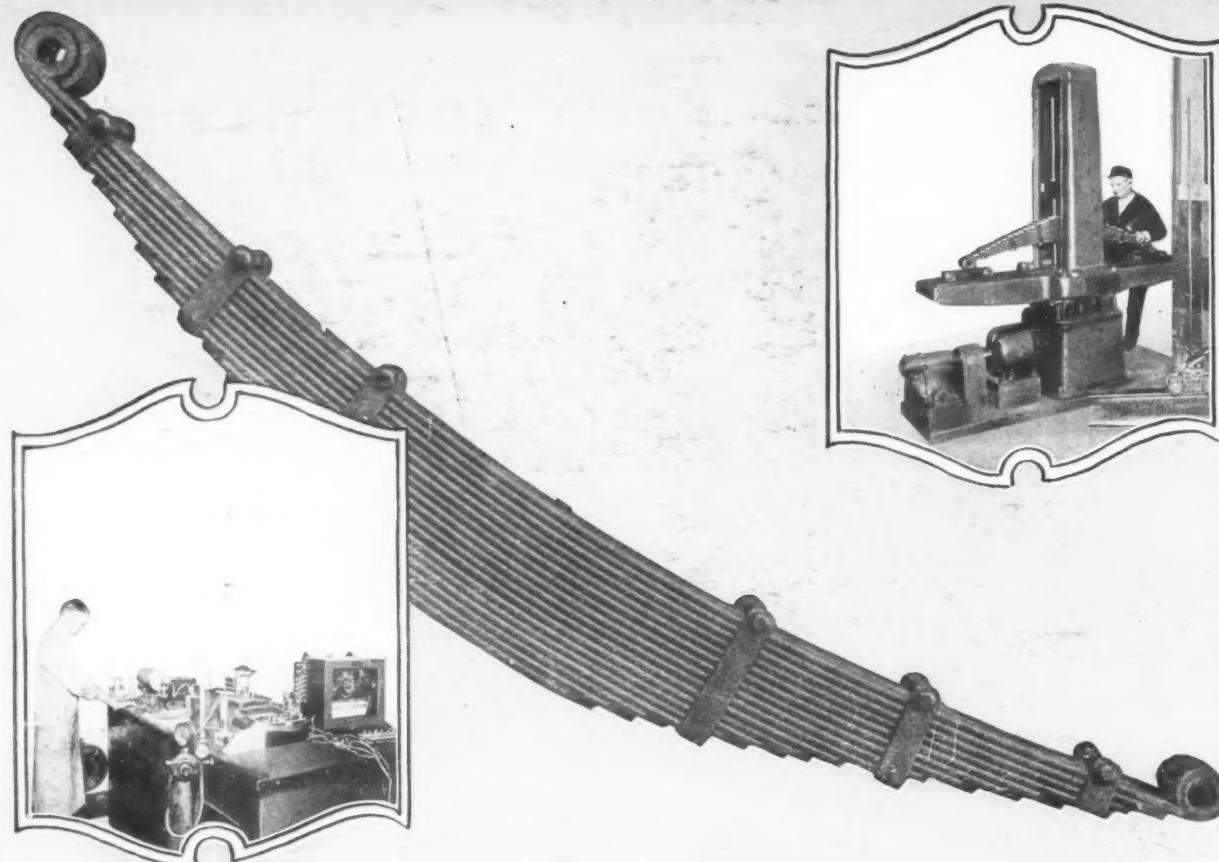
Sheldon advertisements are appearing in a great number of publications, whose combined circulation covers practically the entire truck market.

The pages and double-page spreads reproduced here indicate the character of the copy used by Sheldon in The Saturday Evening Post.

There is no mistaking the influence of this campaign on the judgment of the truck user, an influence that is bound to be felt by the industry and the trade.

The Sheldon-equipped truck will be in a decidedly advantageous position. Wise dealers will bear this well in mind.





Uniformity

The common practice is to heat-treat all spring leaves at the same temperature. This saves time and expense.

But it cannot produce springs of uniform quality. No one has yet devised a means of making the composition of raw spring steel absolutely constant. It varies from one melt to another.

Because of this Sheldon evolved a new method, that of Selective Heat Treatment, to

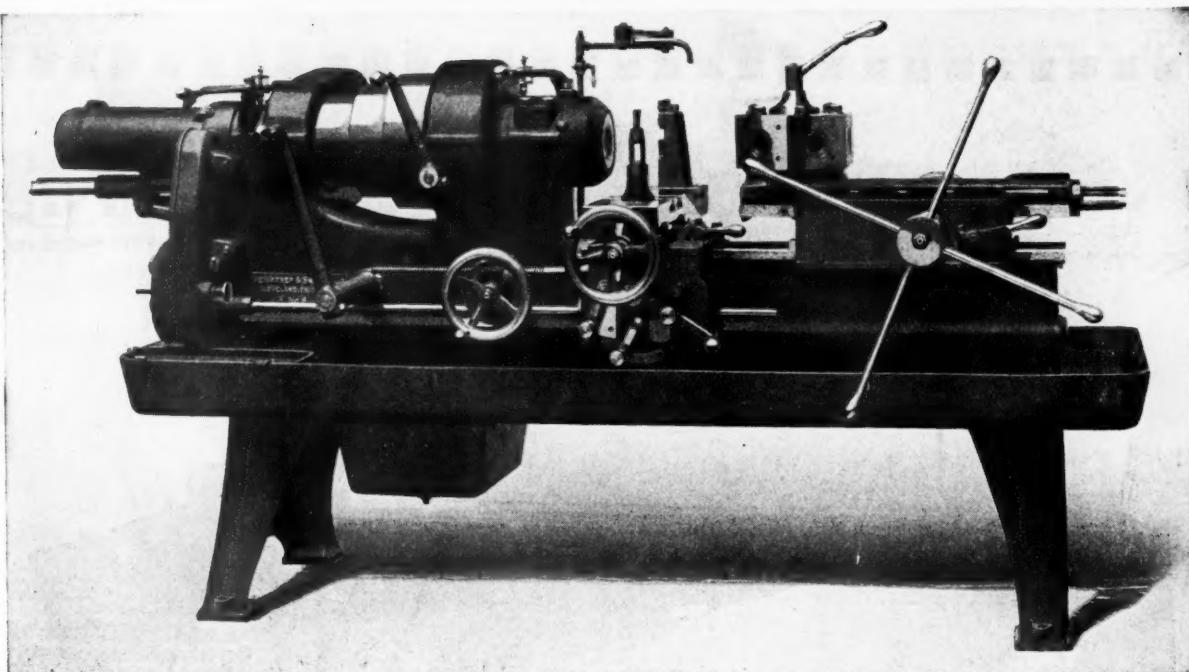
compensate for the variation in the chemical composition of steel.

The Metallurgical Department analyzes each lot of steel as it comes to the plant. From this analysis, the proper heat treating temperature is determined.

This method insures the builder absolute uniformity. He gets the *right* spring—and *the same quality of spring* for every car he produces.

SHELDON AXLE & SPRING COMPANY

Makers of Axles and Springs for Heavy-Duty Service for Over 50 Years
WILKESBARRE, PENNA.



The New W & S Turret Lathe

STRONGER, with more power and greater speed range! Double friction back gears give this new No. 6 Turret Lathe almost double the power which is transmitted by the single back geared machine. Double friction back gears increase the speed range by providing three speeds for each shift of the belt.

The heavy duty carriage with six power cross feeds, together with the double friction back gears, make possible greater production on the **No. 6 Turret Lathe** than on any other machine of its size.

In automobile plants where every minute counts, the new No. 6 Turret Lathe finishes gear blanks, forgings and tough alloy steel parts at lowest cost.

2 1/4" thru the Automatic Chuck
9 1/4" Swing over Carriage
20 1/2" Swing over Bed

The Warner & Swasey Company
Cleveland, Ohio, U. S. A.

BUFFALO OFFICE: Iroquois Building BOSTON OFFICE: Oliver Building
NEW YORK OFFICE: Singer Building DETROIT OFFICE: Ford Building
CHICAGO OFFICE & SHOW ROOM: 618-622 Washington Boulevard



These



THE 7 POINTS

Upon Which SECO SERVICE Is Built

1. Establish Tolerances. Analyze Accuracy Required. Specify Limits on all Drawings.
2. Operation Sheets. Proper Sequence of Machining Operations. Tools, Gages and Machinery Required.
3. Tool Layouts. Diagrammatic Layout of Tools.
4. Tools and Fixtures. Experienced Designers' High Grade Tools.
5. Gaging System. A System Based on Fundamental Principles. Limits that Tie Up. Assurance of Assembling.
6. Operator's Instruction Sheets. Specific Instructions to the Operator. Speeds, Feeds, Tool Equipment Needed and Production Specified.
7. Installation of Tools. Supervision of Installation of Tools. "Cut and Try" Methods Eliminated.

Ask us about the tool layout sheets that went with this job—how they helped the production manager, and so forth. It's mighty interesting.

SERVICE ENGINEERING CO.

558 Jigs, Fixtures and Gages Designed in 112 Days

*—Pretty good evidence of
Seco Speed and Skill—Isn't It?*

Here we show, instead of the tools themselves, the tool layouts we made for this job which show sequence of operations, machines used, etc., so that the production manager has for ready reference and in easily accessible form a complete record of each operation involved.

Tool designing, while vitally important, is but a part of the service we offer.

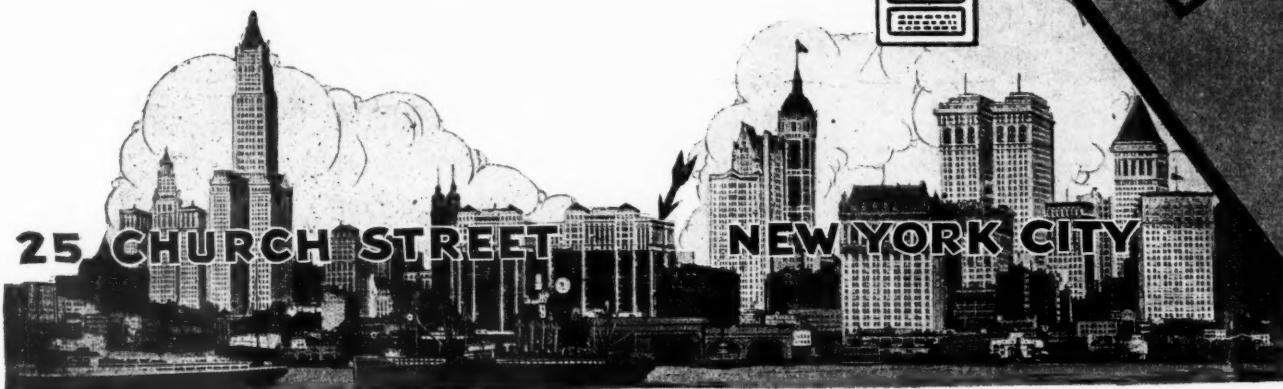
The outstanding features of SECO SERVICE are, first of all, speed and skill in designing of tools which will in turn insure speed and skill on the jobs for which they are made. To insure speed and skill in operation, we go a step farther than the ordinary tool designer. Such "extras" as the layout sheets shown here, workman's instruction sheets, and so forth, put SECO SERVICE in a class by itself. In other words—SECO SERVICE not only designs high-grade tools but insures profitable production from those tools.

We believe this is the kind of tool designing service you want.

Send TODAY for a copy of our book "Complete Engineering Service." It tells our story. It deals with facts. It's interesting, and should be in the hands of every man in the automotive industry who is in any way responsible for tools and production in his shop.

What this service is, what it does for production and the vital need for it is explained in our book—"Complete Engineering Service."

Where shall we send your copy?



New Process Lewis Springs

Set A New Standard Of Spring Accuracy

Each Lewis New Process Machine made leaf spring is an exact counterpart of all others of the same type.

For instance: The last spring in a hundred thousand or a million run, for that matter, is identically—precisely the same as all the others.

It has to be, because *each New Process Lewis Spring is automatically machine formed and machine tempered*—a mathematically accurate duplicate of each preceding spring of any given type.

There is not the slightest variation in shape, or in resiliency, or in weight resisting qualities.

That means an end to assembly installation troubles so far as spring “matching-up” and “spring balance” is concerned.

Then, Lewis New Process Springs have many other exclusive superiority points of excellence, and, complete details will prove interesting and profitable to any automotive vehicle manufacturer.



Every essential detail of the Lewis-Baker Spring Making Machine is protected by patents. Infringers will be prosecuted to the full limit and held financially responsible to the maximum extent. Several patent pirates have already paid the penalty, and, at the same time assisted us in establishing the legal validity of the patents covering the Lewis-Baker Spring Making Machine.

The Lewis Spring and Axle Co
- CHELSEA - MICHIGAN -



To the Automotive Accessory Manufacturer



Your Strongest Sales Arguments
Are—Accuracy of Product—Day
in and Day Out Efficient Per-
formance—Prompt Deliveries

Our strongest selling claim for the Tilted Rotary is that it is one of the greatest aids to the faster production of accurate, dependable products.

Duplicate milling can be done on an Ohio Tilted Rotary at production rates never before attained. Seconds per piece is the usual production time. Station milling is the method. A rotating tilted table is the principle. This table carries from one to seventy-two holding fixtures. Work is loaded and unloaded at front of machine. The rest of the operation is automatic. Each successive piece is fed to milling position where cutter advances, automatically makes the cut and returns to former position until next piece is brought into place when the operation is repeated.

Let us know your particular duplicate milling problems. The Tilted Rotary has a profitable solution.

Oesterlein Machine Co.
Cincinnati, Ohio

MILLERS OHIO GRINDERS

"TOOLS IN WHICH EVERY OUNCE WORKS"



OS. TERLEIN SAYS:

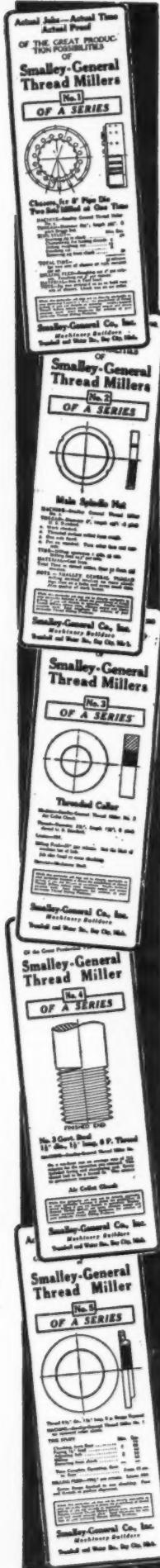
"The demand for cars, trucks and tractors has set a stiff pace for the accessory manufacturer. It isn't 'business as usual,' but 'business unusual.' Your share depends on your production facilities. For profit's sake, let the Tilted Rotary aid you."

"Yours
"For Production."



OHIO TILTED ROTARY MILLING MACHINE

MADE BY OESTERLEIN FOR PRODUCTION



Announcing an
INCREASED
CAPITALIZATION
of the

Smalley General Co., Inc.

In order to both serve and satisfy the increasing demand for Smalley General Company products, it has become necessary to increase the capitalization of this company from \$50,000 to \$525,000. This we regard as a tribute to the excellence of Smalley General Product.

The new capitalization will be utilized to promote the development of thread milling and to increase production. This new capitalization is paid up in full. It has no bonded, mortgage or other funded indebtedness. It has no floating indebtedness save for current accounts. The company will discount its bills.

The management and officers of the company remain the same. The new stockholders are

John W. Eddy, Skinner-Eddy Corporation, Seattle, Wash.
James G. Eddy, Ferry-Baker Lumber Company, Everett, Wash.
R. B. Eddy, Eddy Investment Company, Bay City, Mich.
Howard F. Smith, Michigan Pipe Company, Bay City, Mich., and Dominion Sugar Co., Chatham, Ontario.
J. R. Decker, Sales Manager, Smalley-General Co., Bay City, Mich.

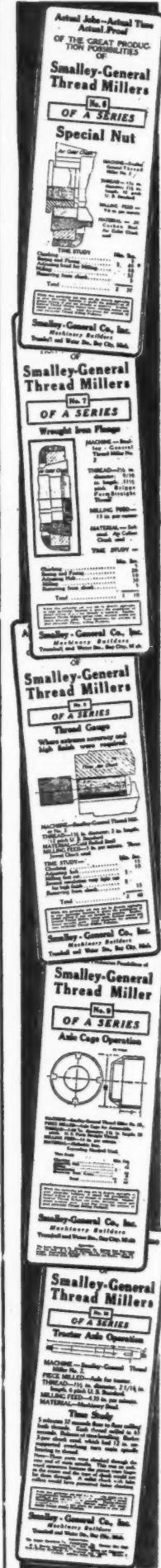
SMALLEY GENERAL CO., Inc.

Machinery Builders

Trumbull and Water Streets, Bay City, Mich.

Agencies:

The Luster Machinery Co., Philadelphia, Pa.
E. L. Eseley Machinery Co., Chicago, Moline and Milwaukee.
Rudel-Belnap Machinery Company, Montreal and Toronto.
Thos. I. Cochran, Addison Hotel, Detroit.





Put It Up to Bullard Engineering Service to Show You Savings

The Bullard MULT-AU-MATIC has made deep cuts in manufacturing costs wherever installed. The steady stream of mechanically paced production flowing through the hands of its single operator reduces in great measure the various factors which make up costs, setting new low figures on the cost sheet.

This is the invariable performance of the MULT-AU-MATIC. Scores of installations have made it the rule, the only difference in a wide variety of cases being in the amount of savings made on the original machining cost. Any number of cases can be cited where MULT-AU-MATIC production time was one-sixth to one-tenth that of other methods on well-tooled and thoroughly modern machines.

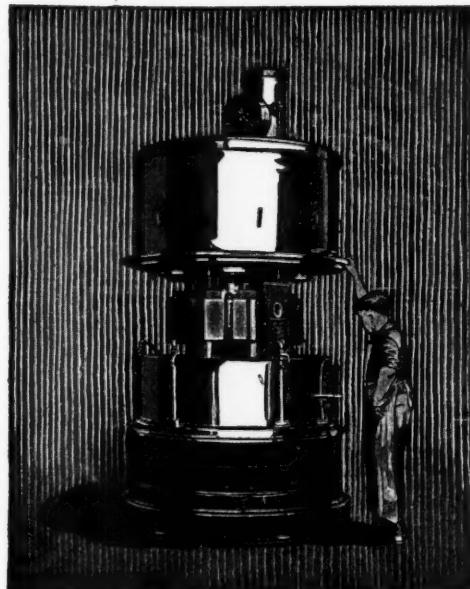
The Bullard MULT-AU-MATIC was designed to, and does, meet to-day's insistent demand for greater and still greater production at lower and still lower costs.

On flywheels, gear blanks, small motor frames, roller and ball bearing cups and races, etc., it is raising production peaks. Savings up to 80% over former methods are matters of record.

You cannot afford to overlook the possibilities of such savings in manufacturing your product. Consult our Engineering Service Department. Our recommendations are backed by an organization which has had an unbroken experience of thirty-eight years as makers and users of machine tools designed for the economical manufacture of metal parts. It is an assurance of intelligent co-operation in meeting your production requirements.

The first step is yours; and we are waiting to serve you.

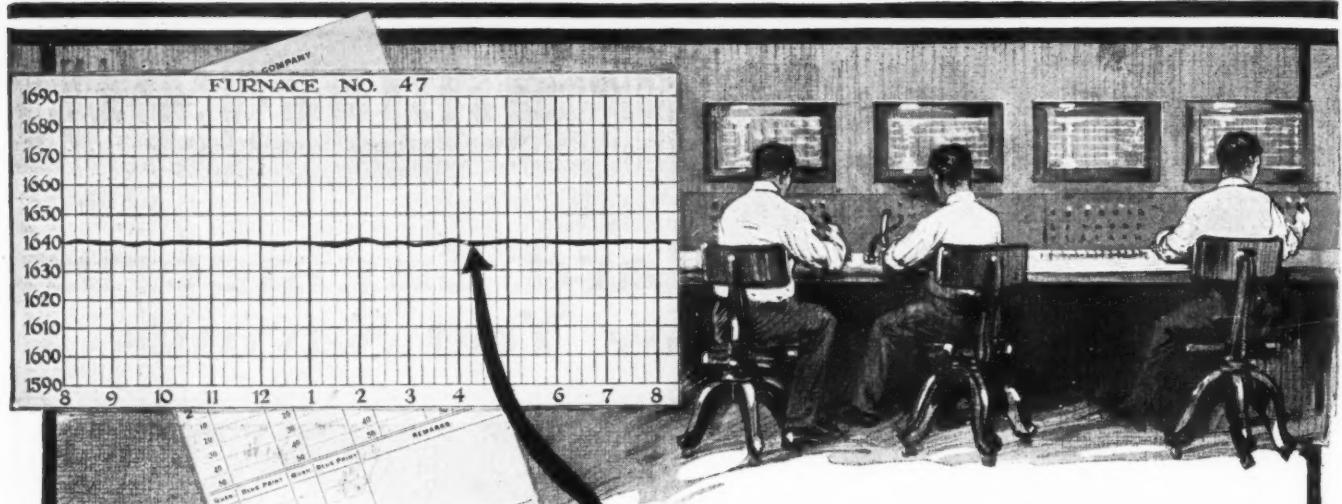
Descriptive literature for the request.



The Mult-Au-Matic



Bridgeport, Connecticut, U.S.A.



This Line-Straight- Helps Keep Your Truck Out of the Shop



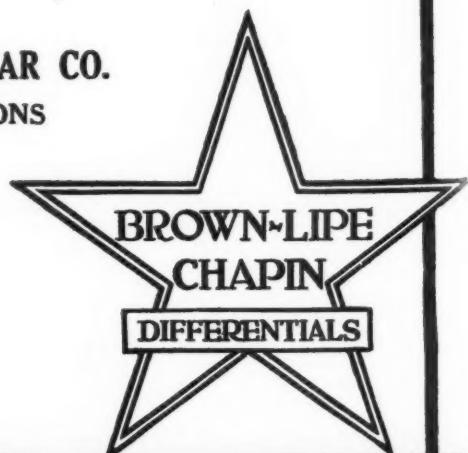
IT shows that furnace 47 — Heat-treating gears for **your** truck—was kept at an **absolutely** even temperature. And the pyrometer readings were taken every 5 minutes.

This extreme care found in every operation and every inspection throughout the entire process of manufacture is to make your Truck's (or Motor Car's) transmission or differential "above suspicion."

BROWN-LIPE-CHAPIN CO.
DIFFERENTIALS

Both at SYRACUSE, N. Y.

BROWN-LIPE GEAR CO.
TRANSMISSIONS



No. 6 of 40 Reasons for Superiority

RIVETT
Quality

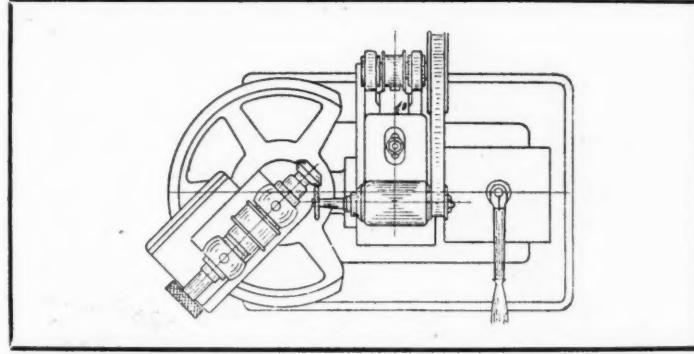
"A time-proved quality that extends to every part of every Rivett Product and is reflected in the work they do."

Another Job
That Is Better Done
on a
RIVETT
RADIAL GRINDER

RIVETT
Service

"A never-ending service in promptly supplying repair parts and operating assistance when needed, insures the profitable performance of Rivett Products from the day they enter your plant."

RIVETT
No. 205
Radial Grinder



**Grinding External Straight or
Taper Work of Short Length**

As a means of developing true spherical surfaces by the oscillating method, the Rivett Radial Grinder is truly a wonder machine tool and its usefulness does not end there. The grinding of straight and taper internal and external work of short length can also be handled particularly advantageously on this machine.

Take the job shown above, for instance. Piece is held in fixture on headstock. Headstock is set and locked at proper angle and wheel is moved back and forth across the work by lever A.

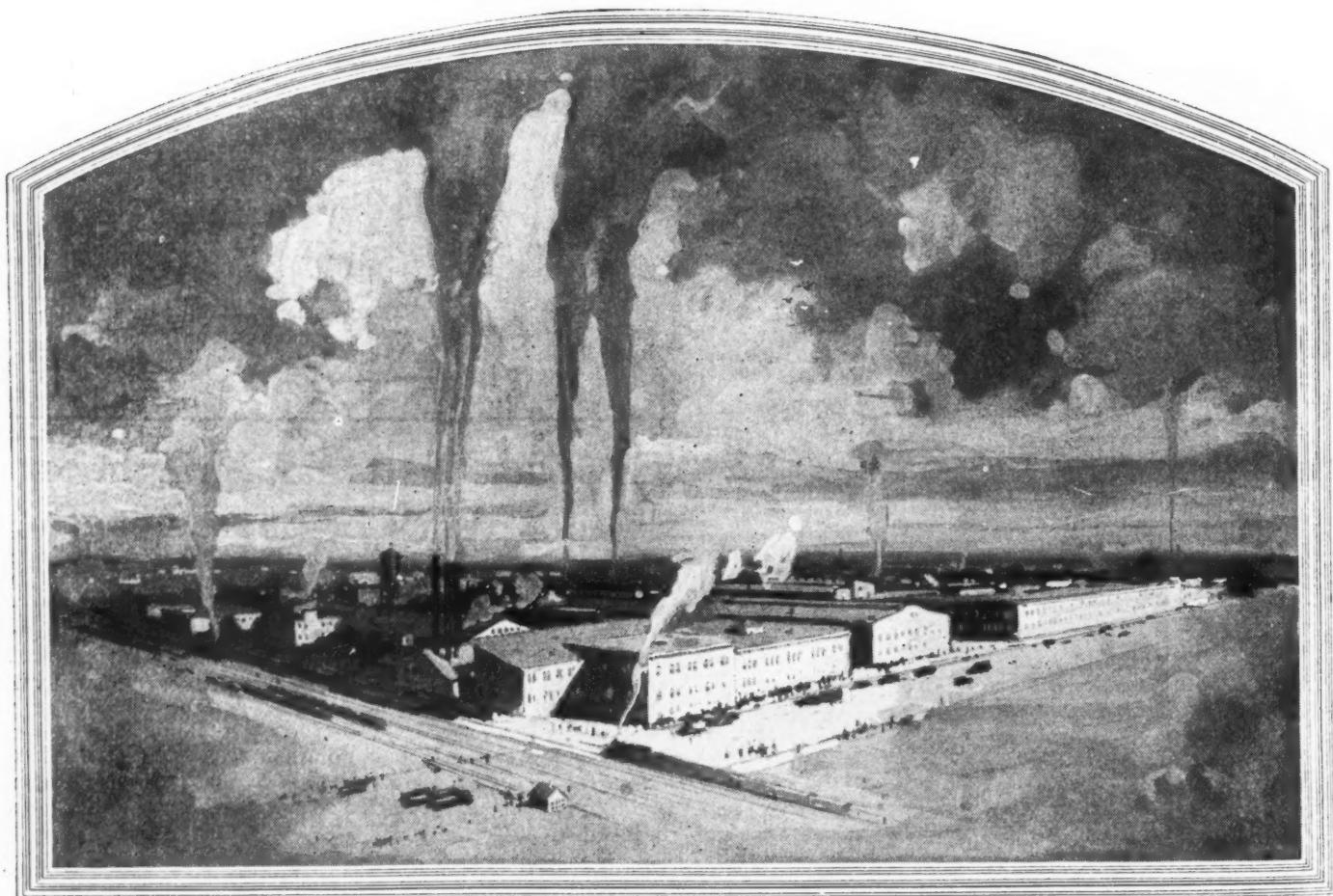
Both from the viewpoint of production and accuracy, this is a particularly efficient way to handle this job.

Send for detailed description of this machine TODAY.

RIVETT LATHE and GRINDER COMPANY
BRIGHTON DISTRICT of BOSTON, MASSACHUSETTS
"MAKERS OF THE WORLD-KNOWN RIVETT PRECISION LATHE"

DOMESTIC AGENTS: The Fairbanks Company, Boston, Mass.; Purinton & Smith, Hartford, Conn.; Patterson, Gottfried, & Hunter, Inc., New York City; Homer Strong, Rochester, Buffalo, Syracuse and Albany; D. Nast Mchly. Co., Philadelphia, Pa.; Somers, Fitter & Todd Co., Pittsburgh, Pa.; Cleveland Tool & Supply Co., Cleveland, Ohio; The E. A. Kinsey Co., Cincinnati, Ohio, Indianapolis, Ind.; J. R. Stone Tool & Supply Co., Detroit, Mich.; Dale-Brewster Machinery Co., Chicago, Ill.; Blackman-Hill-McKee Machinery Co., St. Louis, Mo.; F. E. Satterlee Co., No. Minneapolis, Minn.; Hallidie Mchly. Co., Seattle, Wash.; Hendrie & Bolthoff Mfg. & Sup. Co., Denver, Colo.; Portland Mchly. Co., Portland, Ore.; Smith-Booth-Usher Co., Los Angeles, Cal.; F. O. Stallman, Supply Co., San Francisco, Cal.; Utah Mchly. Co., Salt Lake City, Utah. FOREIGN AGENTS: H. W. Petrie, Ltd., Toronto, Canada; Fenwick Freres, Paris, France, Belgium, Switzerland, Italy, Spain, Portugal; Buck & Hickman, Ltd., London, Glasgow, Manchester, Sheffield and Birmingham; A. B. Galco, Ltd., Stockholm, Sweden.

SALISBURY AXLES



Our huge plant at Jamestown, New York, covers more than twelve acres of floor space and is recognized as one of the most completely equipped factories in the nation. Here we devote ourselves exclusively to the production of Motor Car Axles that must measure up to an

unfaltering standard of excellence. *Salisbury* quality is now a traditional phrase because ours is the oldest Axle plant in the Motor Car Industry. All of our energies, all of our equipment and all of our resources are dedicated to the single task of protecting and developing the reputation that our product has honestly won.

SALISBURY AXLE COMPANY, JAMESTOWN, N. Y., U. S. A.

A G & E Worm Wheel Generator Assures a Successful Drive

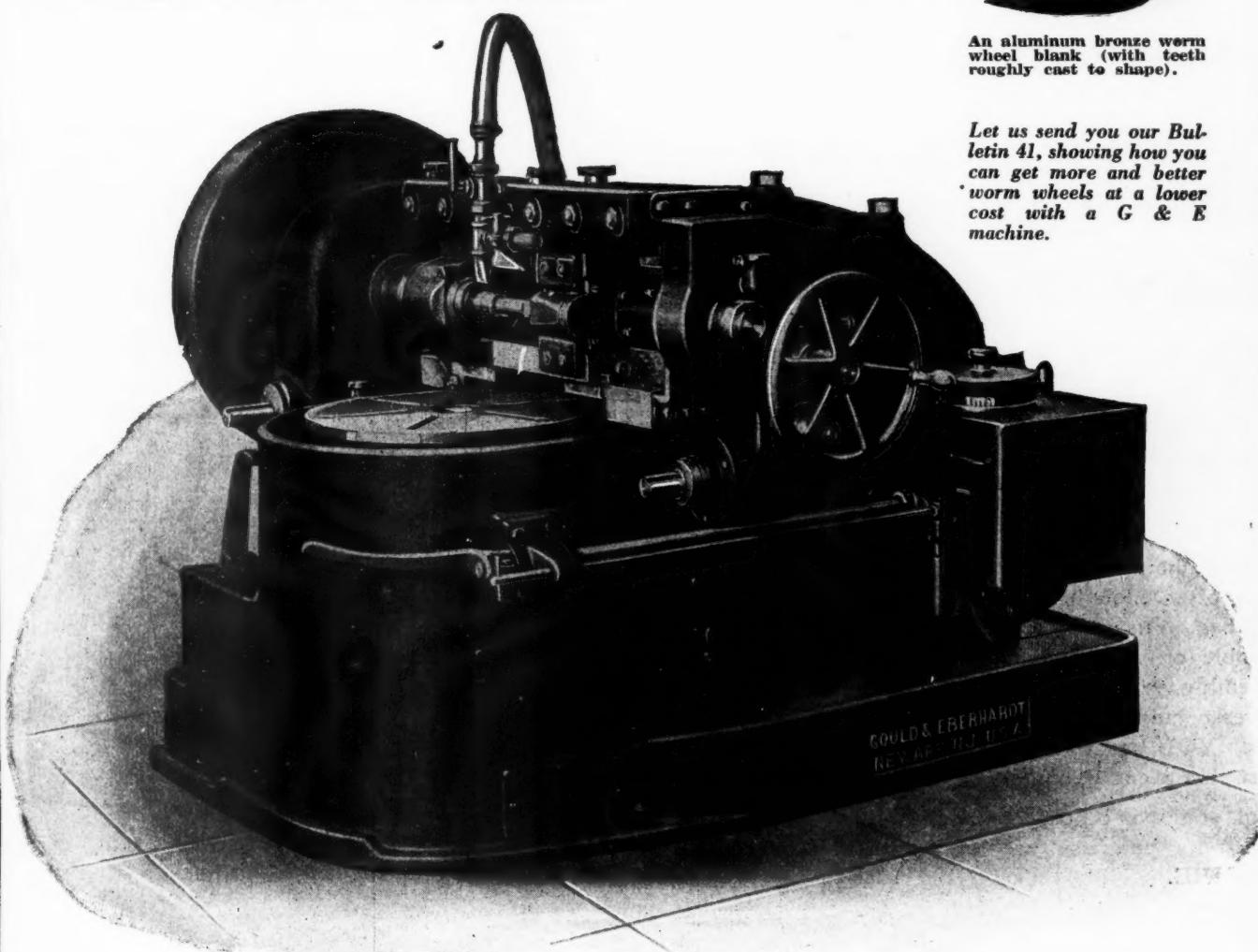
THE SUCCESS of the worm and worm wheel drive depends largely upon the accuracy and smoothness with which the worms and worm wheels are finished.

The G & E Worm Wheel Generator has all the features that are necessary for accurately and smoothly finishing worm wheels for use in motor trucks, tractors and worm gear reduction sets. It has both tangential and infeed features and uses a straight or tapered hob or flytool.



An aluminum bronze worm wheel blank (with teeth roughly cast to shape).

Let us send you our Bulletin 41, showing how you can get more and better worm wheels at a lower cost with a G & E machine.



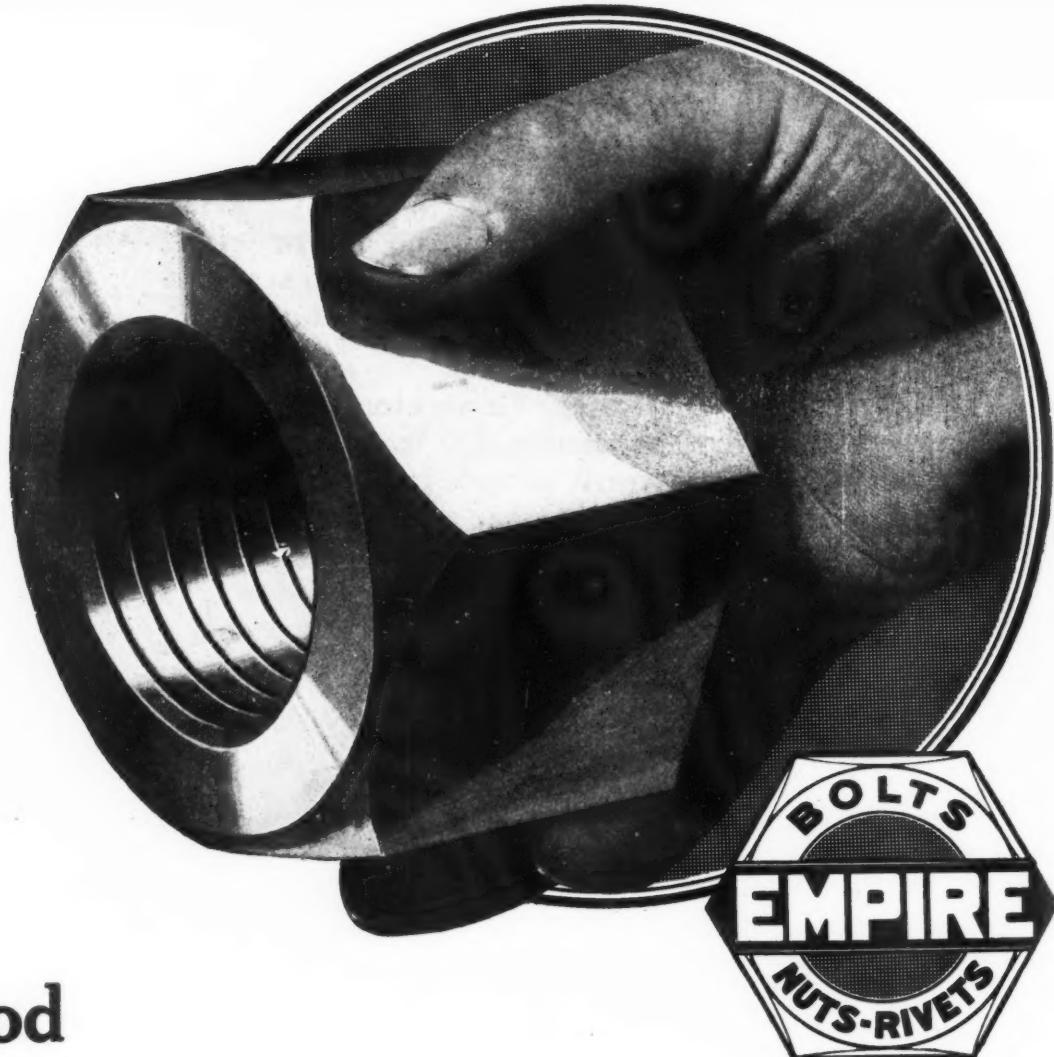
Gould & Eberhardt No. 18 W Worm Wheel Generator

GOULD & EBERHARDT

"HIGH DUTY" SHAPERS
AUTOMATIC GEAR AND RACK CUTTING MACHINERY

ESTABLISHED 1833

NEWARK, N.J. U.S.A.



They Have to Make Good

Bolts and nuts do more than join the assembled parts of a car or truck or tractor.

They make up the sum total of difference, often enough, between good will and bad. For a belt or nut that makes trouble on an otherwise high grade assembly, is as likely as not to bring adverse judgment on the whole product. **YOU** can offer no excuse for a part that went wrong.

And you won't need to, if the bolts and nuts you use are trademarked **EMPIRE**.

Behind the skill and efficiency that insure microscopic limits of accuracy, enduring strength — thoroughgoing quality — are three-quarters of a century of fruitful experience in the manufacture of Empire Bolts and Nuts.

These are the highest grade bolts and nuts in the world, in every sense of the term—fully guaranteed as to quality of material and workmanship. In no way can you get fuller assurance of uniform dependability than by specifying Empire.

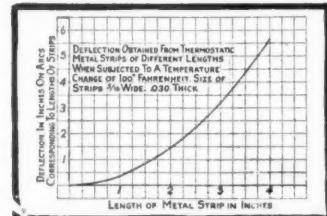
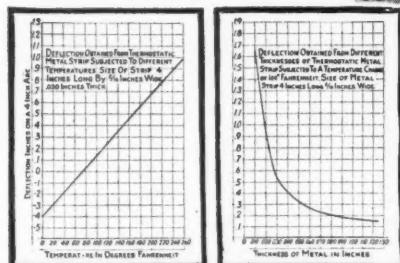
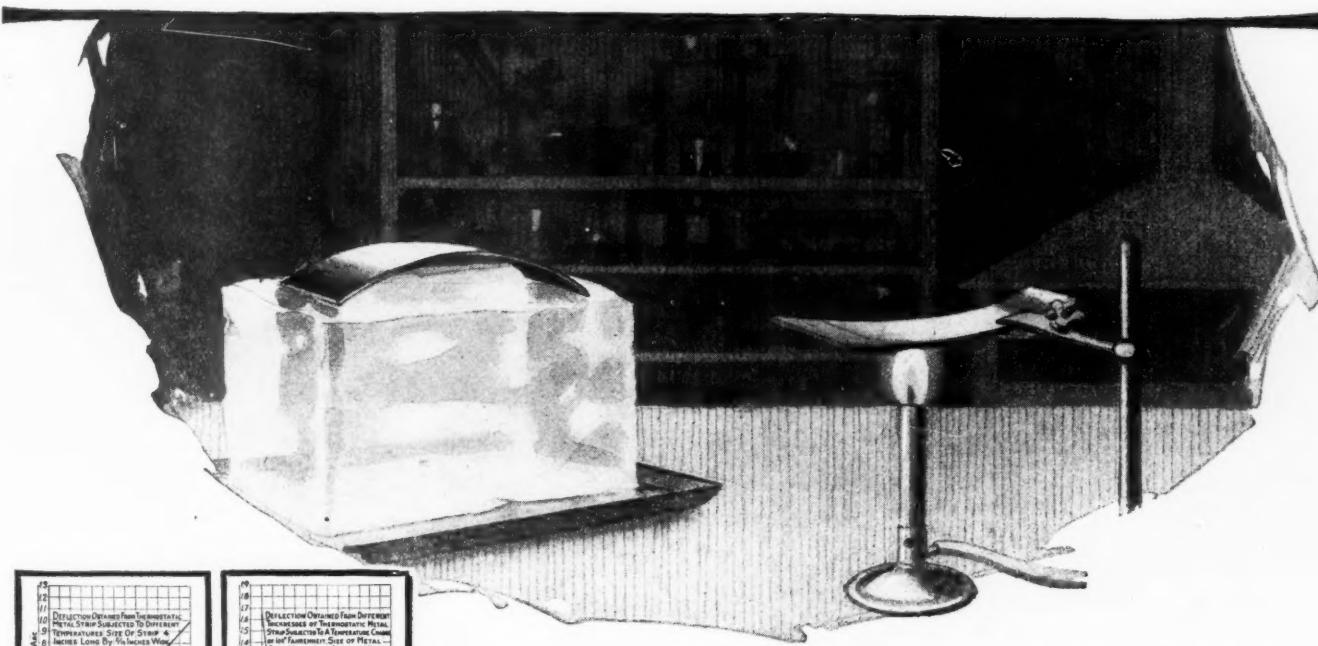


RUSSELL, BURDSALL & WARD • BOLT & NUT COMPANY •

PEMBERWICK, CONN. PORT CHESTER, NEW YORK ROCK FALLS, ILLINOIS

Makers of Bolts, Nuts and Rivets Since 1845

Many devices operate at increased efficiency or with greater accuracy when temperature compensation is provided automatically



These curves and others that show the effects of the definite laws governing G-E Thermostatic Metal's performance are reproduced in the Booklet B-345,—"G-E Thermostatic Control." It is yours for the asking.

The Curve of G-E Thermostatic Metal Is the Curve of Greater Efficiency or Accuracy

G-E THERMOSTATIC METAL (Patented Dec. 18, 1917) takes a curve or straightens, in accordance with definite laws as the temperature rises or falls. It consists of two metals of widely different coefficients of expansion, permanently joined throughout their lengths.

The sensitiveness of this metal to temperature changes has solved the problem of thermo-control in a wide variety of devices. It is used to maintain constant temperatures or to compensate for changes in scales, balances, scientific instruments, furnaces, incubators, refrigerators, electric heaters, ice machines, thermostats, carburetors and in battery-charging outfits, and signal equipment.

If you have a heat compensation problem, our specialists will be glad to assist you. Write the address below.

General Electric
Fort Wayne Dept.,
Fort Wayne, Ind. Sales Offices in
all large cities.



The Joint of Universal Satisfaction

THE HARTFORD AUTOMOTIVE PARTS CO.

Hartford, Conn.

Inc. 1906

Hartford
UNIVERSAL JOINTS



What Does "Heat Treated" Mean?

"Heat-treated" is a term that may mean much or little. It may mean that a steel part has been hurriedly heated and hastily hardened, or that it has been carefully, exactly and scientifically treated as it is in the Nuttall BP Process.

The Nuttall BP Process of heat treatment goes further than a hardening of wearing surfaces. It hardens the steel clear through, and adds greatly to the wear-resisting ability of the metal as well.

The BP Process was originated by Nuttall engineers and has been used with remarkable success on gears for electric locomotives and cars, motor trucks, heavy

industrial machinery and in other kinds of service.

It has been so successful in fact that when comparative tests can be made under identical conditions Nuttall gears are unqualifiedly guaranteed to last four times as long as untreated cast-steel gears.

Nothing speaks more strongly for the quality of Nuttall Gears than the fact that Nuttall has never had to replace a single gear under this guarantee.

The real meaning of "heat-treated" is explained more fully in the booklet "Pedigreed Gears." Write for a copy.

R. D. NUTTALL COMPANY, Tractor Dept., 2133 Conway Bldg., Chicago. Works, Pittsburgh, Pa.

Nuttall Gears

EVERY GEAR REGISTERED

Hayes Policy

*Expert Workmanship
Close Cost Figures
On Time Deliveries*



Hayes Products Are the Result of Faithful Service

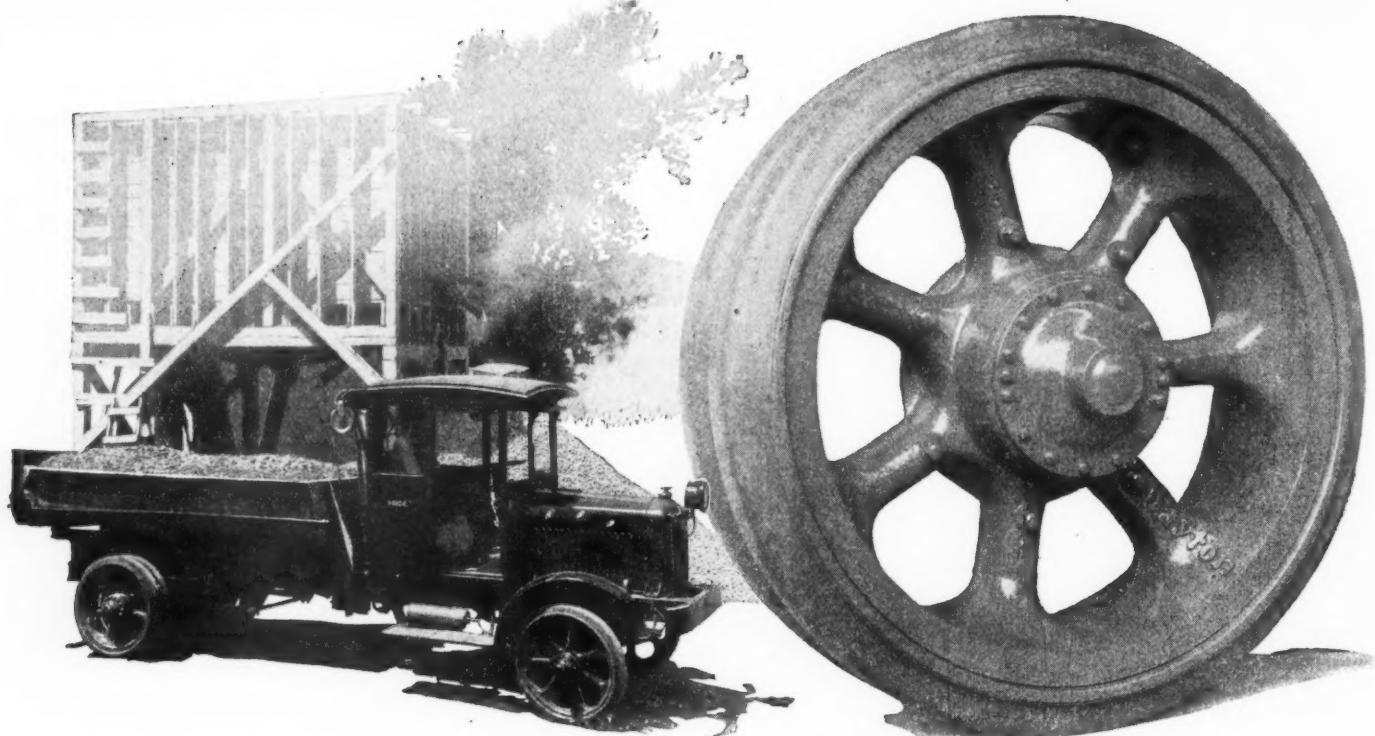
THE Hayes Manufacturing Company numbers among its forces scores, whose pleasant association with the company dates from its existence.

These workmen during faithful service, have encountered problems and solved them. They are experts, not by adoption but by experience—and what's more because they definitely apply Hayes principles.

They are prompted by something higher which they themselves live and feel and which is more important to their work than even their tools or materials. So Hayes results come from a genuine willingness to do.

Automotive manufacturers are coming to know the products of the Hayes workmen by their fineness—that difference put there not by machine but by an intangible something described as spirit. Hayes spirit.





Showing One of the Recent Paige Trucks Wearing Dayton Steel Wheels

Are Your Trucks Equipped for the Contractor?

There is probably no service which subjects the truck and especially the wheels to greater strain than that of the contractor.

All kinds of streets, unpaved roads, gravel pits and similar wracking routes must be traveled.

It is because of these severe strains that most contractors now buy only trucks equipped with steel wheels—with Dayton Steel Wheels.

Do your trucks meet this preference of the contractor or must he purchase a competitive truck to secure them? Your truck fitted with Dayton Steel Wheels will enable you to cash in on this demand.

Dayton Steel Wheels are more than equal to any



usage to which they can be put. They never develop any of the prevalent wheel faults, such as wobbles, flats, loose spokes and so forth.

With this greater strength, Dayton Steel Wheels in the 5-ton truck size are as much as 100 pounds lighter per set than any other wheels. In no case are they any heavier than other wheels. These wheels are also saving in tires, adding from 10 to 30 per cent to the life of them.

Our Engineering Department will show you how these wheels will enhance the appearance of your truck and increase its selling power. Write

THE DAYTON STEEL FOUNDRY COMPANY

Main Office and Works, Dayton, Ohio

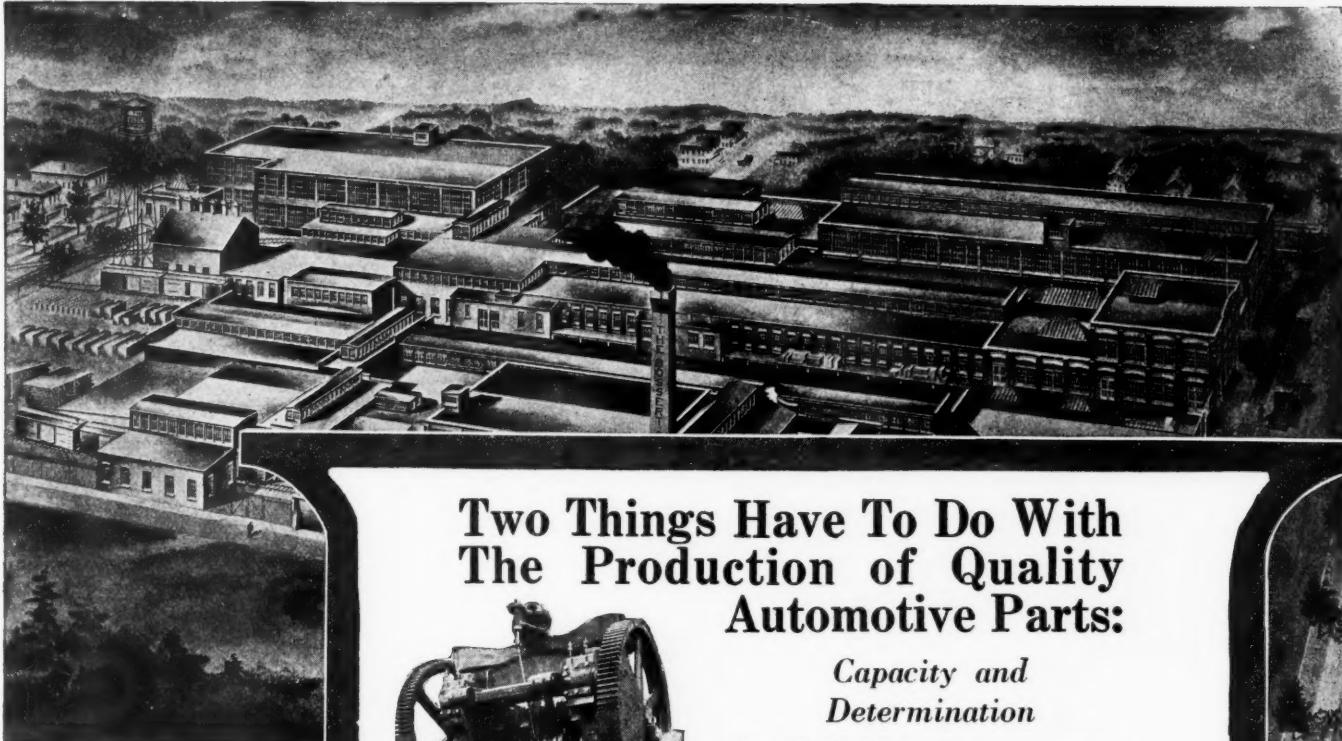
Detroit, 1008 Chamber of Commerce
Chicago—975 Old Colony Bldg.

Dayton

Steel Truck Wheels

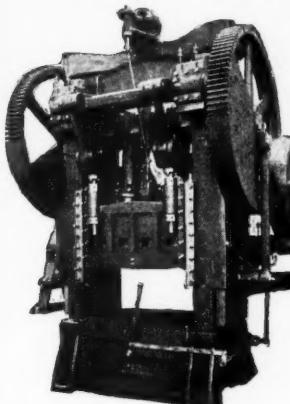
Patented

Cincinnati—416 First Nat'l Bank Bldg.
New York—116 World Bldg.



**Two Things Have To Do With
The Production of Quality
Automotive Parts:**

*Capacity and
Determination*



A GLANCE at the accompanying illustration or a visit to the factory will give you some idea of the capacity of the Bossert plant. It is practically unlimited. The largest presses in the world are at your disposal regardless of your production requirements. The determination to produce the best pressed metal has been the cause of this great plant's upbuilding.

From the time a blue print enters the Bossert plant until the finished product is delivered, the various operations are carefully followed by men whose sole determination is to have Bossert products excel, and who bring to this determination an experience of successful metal stamping many years old.

These things mean much to you—as Bossert engineers will prove.

THE BOSSERT CORPORATION
Main Office and Works Utica, New York

BOSSERT
STAMPINGS

BRANCH OFFICES:
Cleveland, O., 611 Citizens Bldg.
Detroit, Mich., 1513 Ford Bldg.
New York City, 30 Church St.



**Positive Purveyors
of Power**

The absolute dependability of Baldwin Chain Drives on a heavy truck reflects the care and precision of their manufacture.

Their scientific accuracy of pitch, their unfailing strength and certainty of operation and above all their long, care-free life assures complete satisfaction to the owner.

The intelligence and experience of Baldwin engineers are at the service of truck designers and builders.

BALDWIN CHAIN & MFG. COMPANY
WORCESTER, MASS.

H. V. GREENWOOD, General Western Sales Agent
People's Gas Building, Chicago, Ill.

**GENUINE
BALDWIN
CHAINS**

FLEXITE

MEDIUM DUTY

Universal Joints

For Passenger Car Service

FLEXITE

TRADE MARK REGISTERED



ASSEMBLY OF FLEXITE PATENTED MEDIUM DUTY UNIVERSAL JOINT

Other Flexite Products

Flexite Patented Heavy Duty Universal Joints for Trucks.

Flexite Standard Magneto and Generator Couplings.

Flexite Patented Medium Duty Universal Joints are flexible without requiring lubrication.

There are no sliding, rubbing or rotating metal parts in contact to require lubrication.

Flexite cannot become noisy or wear from lack of grease or oil.

Flexite cannot throw out oil or grease.

Its operation is unaffected by water, grease or dirt picked up on the road.

Simple in assembly, Flexite Patented Medium Duty Universal Joints never require attention for lubrication or adjustment.

ASK FOR FURTHER INFORMATION

F.R.BLAIR&CO. INC.
50 CHURCH STREET
NEW YORK

Lift jaw; slide to desired size; drop into mesh. In an instant you get any one of ten sizes.

Ten sizes:
 $\frac{1}{4}$ ", $\frac{5}{16}$ ", $\frac{3}{8}$ ", $\frac{7}{16}$ ",
 $\frac{1}{2}$ ", $\frac{19}{32}$ ", $\frac{11}{16}$ ",
 $\frac{25}{32}$ ", $\frac{7}{8}$ ".



No. 120

LIST PRICE

\$1.50

Patents Pending in the
United States and Foreign
Countries.

Every Man Who Buys Your Car Will Appreciate it

The Wizard takes the place of 5 double end Wrenches in the tool kit. Working with a Wizard is like having all five in your hand at once ready for use on any nut that comes along. The Wizard saves you searching through your tool box for the right wrench.

All nuts are one size to the Wizard. Just lift the jaw, slide it to the size you want and drop it into mesh with the ratchet teeth. It fits the nut exactly and works without back lash.

It is a wrench you can be proud to put in your car. It is up to the highest standards of quality. It is sturdily built from special carbon steel, hardened and toughened by special heat treatment. It has the perfect balance for which Wakefield Wrenches have been famous for thirty years.

*Write us for prices on quantity orders.
(Or, write us for special proposition to car
builders.)*

Sole Manufacturers

C. E. WAKEFIELD
Worcester, Mass., U. S. A.

MAKERS OF Automobile,
Bicycle and Motorcycle Wrenches.
Wrench Manufacturers For Over
Thirty Years

**The Wizard
Wrench is $7\frac{3}{4}$ "
long,
 $\frac{3}{8}$ " thick,
 $2\frac{1}{8}$ " wide.**

Instantly Adjusted
to Ten Sizes—
5 S. A. E. Sizes.
6 U. S. Standard
Cap Screw Sizes.
4 Set Screw Sizes.
10 U. S. Standard
Sizes.
Without knurl ad-
justment. Every
opening is absolute-
ly positive.



No knurl adjustment.
No back lash.

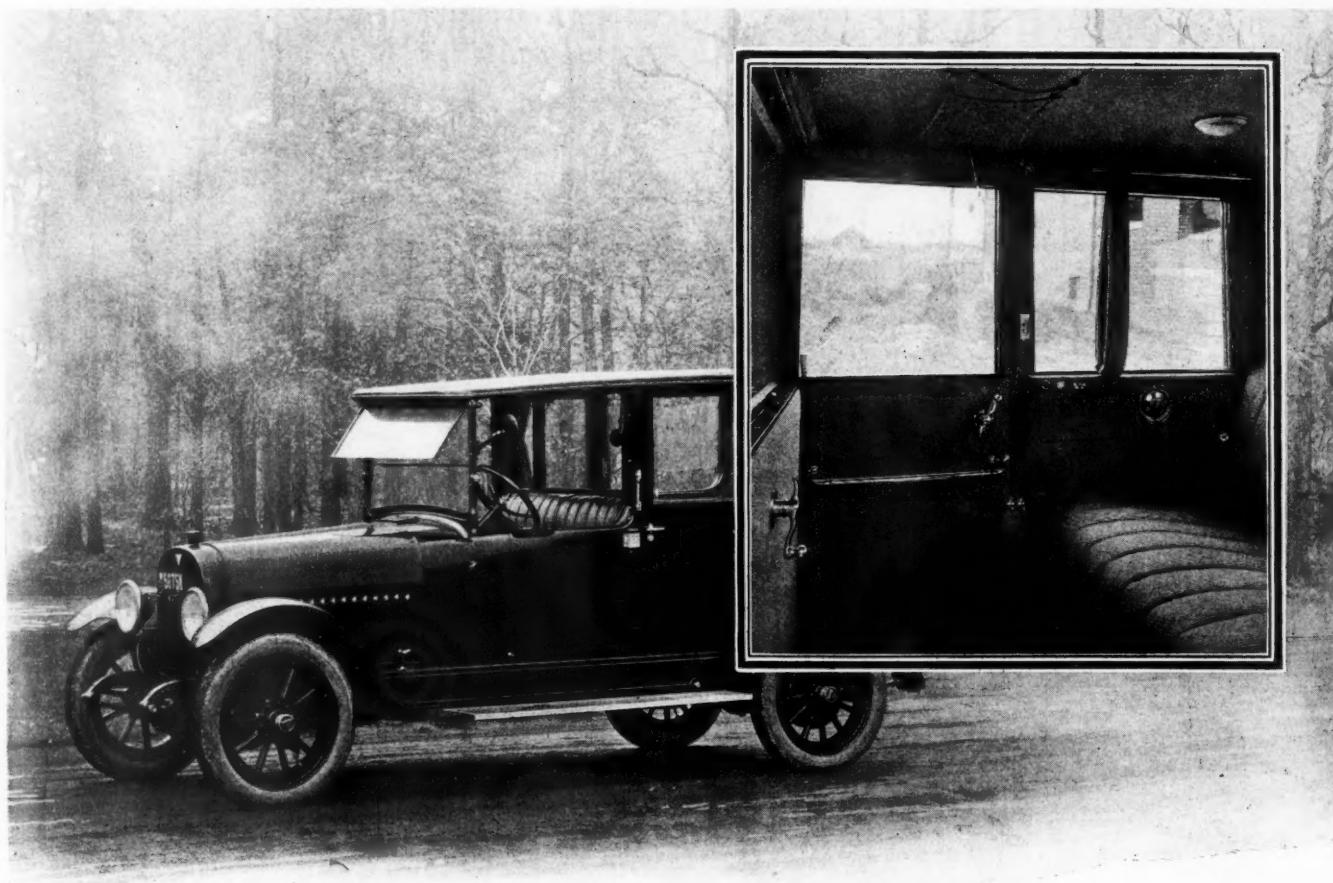
A push of the thumb will make any
adjustment.

WAKEFIELD
WIZARD WRENCH
ADJUSTABLE OPEN END

C. E. WAKEFIELD

WRENCH MANUFACTURERS
FOR OVER THIRTY YEARS

Worcester, Mass., U. S. A.



TO complete the luxurious appointments of the Hudson coach interiors they have added the Perfect Window Regulator.

Automotive engineers and fine body builders have been specifying the Perfect Window Regulator for the past ten years.

The regulator is simple in construction. It is easy to operate. Any necessary adjustments of the counterbalancing spring to meet operating conditions may be made without removing the regulator. This exclusive Perfect Window Regulator feature appeals to all body builders.

Not only the Hudson, but this list of cars at the right have the Perfect Window Regulator as standard. See these cars at the show.

PERFECT WINDOW REGULATOR CO.

20 Exchange Place

New York City

You will find the Perfect Window Regulator on these cars.

Marmon

Hudson

Franklin

Cunningham

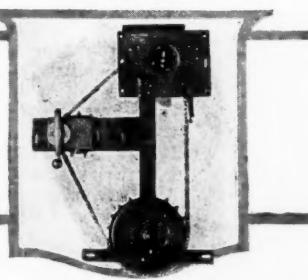
Pierce Arrow

Cole

Standard Regulator.



Offset Type for Rear Quarter Window.



*The Perfect
Window Regulator*



The railways of the United States are more than one-third, nearly one-half, of all the railways of the world. They carry a yearly traffic so much greater than that of any other country that there is really no basis for comparison. Indeed, the traffic of any two nations may be combined and still it does not approach the commerce of America borne upon American railways.

United States Senator Cummins.

ASK any doughboy who was "over there" and he will tell you that American railroads are the best in the world.

He saw the foreign roads—in England and France, the best in Europe—and in other Continental countries—and he knows.

The part railroads have played in the development of the United States is beyond measure.

American railroads have achieved high standards of public service by far-sighted and courageous investment of capital, and by the constant striving of managers and men for rewards for work well done.

We have the best railroads in the world—we must continue to have the best.

But they must grow.

To the \$20,000,000,000 now invested in our railroads, there will have to be added in the next few years, to keep pace with the nation's business, billions more for additional tracks, stations and terminals, cars and engines, electric power houses and trains, automatic signals, safety devices, the elimination of grade crossings—and for reconstruction and engineering economies that will reduce the cost of transportation.

To attract to the railroads in the future the investment funds of many thrifty citizens, the directing genius of the most capable builders and managers, and the skill and loyalty of the best workmen—in competition with other industries bidding for capital, managers and men—the railroad industry must hold out fair rewards to capital, to managers and to men.

American railroads will continue to set world standards and adequately serve the Nation's needs if they continue to be built and operated on the American principle of rewards for work well done.

*This advertisement is published by the
Association of Railway Executives*

Those desiring information concerning the railroad situation may obtain literature by writing to The Association of Railway Executives, 61 Broadway, New York.

PASSENGER CARS
[REDACTED]
Anderson
Apperson
Baker R & L
Beggs
Brewster
Buick
Cadillac
[REDACTED]
Chalmers
[REDACTED]
Columbia
Comet
Crawford
Crow-Elkhart
Cunningham
Daniels
Davis
Detroit El.
Dixie Flyer
Dodge
Doris
Dort
Douglas
Elgin
Elkhart
[REDACTED]
Essex
Ford
[REDACTED]
Hanson
Harroun
Holmes
Hudson
Jones
Jordan
Kissel
[REDACTED]
Liberty
Locomobile
Luverne
[REDACTED]
Marmon
McFarlan
Maxwell
Milburn
[REDACTED]
Metz
Mitchell
Moline Knight
Moon
[REDACTED]
Murphy

NOMA
Olds
Overland
Packard
Paige
Pan-American
[REDACTED]
Peerless
Piedmont
Pierce-Arrow
Premier
Reo
Revere
Saxon
Scripps-Booth
Simplex
Singer
Standard
Stanley
Stearns
Studebaker
Stutz
[REDACTED]
Velie
Walden W. Shaw
Westcott
Winton

MOTOR TRUCKS
Abbott & Downing
Acason
Acme
Ahrens-Fox
All American
All Power
American
American-LaFrance
Armleder
Atlantic Refining
Atnbury
Autocar
Available
Bessemer
[REDACTED]
Betz
Bourne
Brinton
Brockway
Buckeye
Chevrolet
Chi. Motor Truck Co.
Chicago Pneu. Tool
Clyde
Columbia

Commerce
Commercial Tr. Co.
Corbitt
Crawford
Cunningham
Dart
[REDACTED]
Denby
De Martini
Diamond T
Diel M T W
Doane
Dolt
Doris
Duplex
Emerson
Every Ready
Fageol
Federal
Ford
Four-Wheel-Drive
[REDACTED]
Fitzhenry-Guptill
Gabriel
Garford
Gary
General Motors
Truck Co.
Gersix
Giant T Co.
Golden West
[REDACTED]
Hahn
Halfur
Harvey
Hendrickson
Huffman
Hurlburt
Independent
Indiana
International
Harvester
International
Motor
Jumbo
Kelly-Springfield
King-Zeitzer
Kissel
Kleiber
Koehler
La France
Landover
Lane
Lansden
Lewis-Hall
Little Giant
Lowell
[REDACTED]
Maccar
[REDACTED]
Master
Maxwell
Monomines

Michigan Hearse &
Motor Co.
Moreland
Nash
National Brake
National Steel Car
Nelson Bros.
Nelson & LeMoon
New England
[REDACTED]
Old Hickory
Old Reliable
Oneida
"O K"
Packard
Paige-Detroit
Peerless
[REDACTED]
Pierce-Arrow
Rainier
Reo
Republic
Riddle
Riker
Robinson
Sandow
Sanford
Schacht
Seagrave
Selden
Service
[REDACTED]
Signal
Standard M. T.
Standard Oil of
Ohio
[REDACTED]
Stanley
Sterling
[REDACTED]
Studebaker
Sullivan
Superior
Tiffin Wagon
Tower Truck
Traffic
Transcontinental
Triangle
Turnbull
U. S.
United Moto
Vale
Vlm
Vulcan
Walker
Walker Johns
Walter
Ward
Watson
White Hickory
Nichita Fall
Wilcox
Winther

Who Uses TIMKEN? BEARINGS?



The cars and trucks in the above list have Timken Bearings. Those crossed out have not. The list includes the best known, both in the passenger car and motor truck fields. Counting large and small manufacturers there were produced in the first six months of 1919, 719,000 Timken equipped cars and trucks, and according to the best figures available, 86,000 cars and trucks without Timken Bearings.

The Timken Roller Bearing Co.
Canton, Ohio



Flint Silica Core Sand Insures Better Castings While Cutting Costs

Better Castings because it makes cores that vent so freely, that blows, scabs and similar defects are largely avoided.

Less Cost, because you use 50% less core oil than other sands require. You do this by mixing the dry Flint Silica with the oil before you add the water.

Less cost, also, because less failures, less defective castings, and less "doctoring" and finishing expense.

Send for our Folder:

"A New Way of Making Cores"

UNITED STATES SILICA COMPANY

Sole Producers of Flint Silica

1943 Peoples Gas Bldg.

Chicago

SCREW MACHINE PRODUCTS

THE PROBLEM of turned parts for rapid assembly is first of all a problem of accuracy.

For nearly half a century this company has been specializing in the production, to most exact and unusual specifications, of screw machine products and turned metal parts in general, ranging from the smallest size to six inches in diameter.

H. M. S. accuracy is rigidly maintained by constant and thorough inspection, assuring you against loss of time in assembling.

All H. M. S. parts are milled from solid bars, thus preserving the original grain of the metal for maximum

strength, instead of distorting the texture by cold-punching or heading them. Our prices cover thorough inspection. You can rely on using H. M. S. products 100% without correction.

We offer a factory space of over 200,000 square feet equipped with over 1800 machines, vast resources of the highest types of raw materials, and an efficient and highly trained working force.

Particularly if the specifications are difficult or if interchangeability or uniformity is essential for your production, allow us to figure for you and thus indicate how efficiently we can serve you.

HARTFORD MACHINE SCREW COMPANY

HARTFORD, CONN.

NEW YORK.

DETROIT.

SAN FRANCISCO.

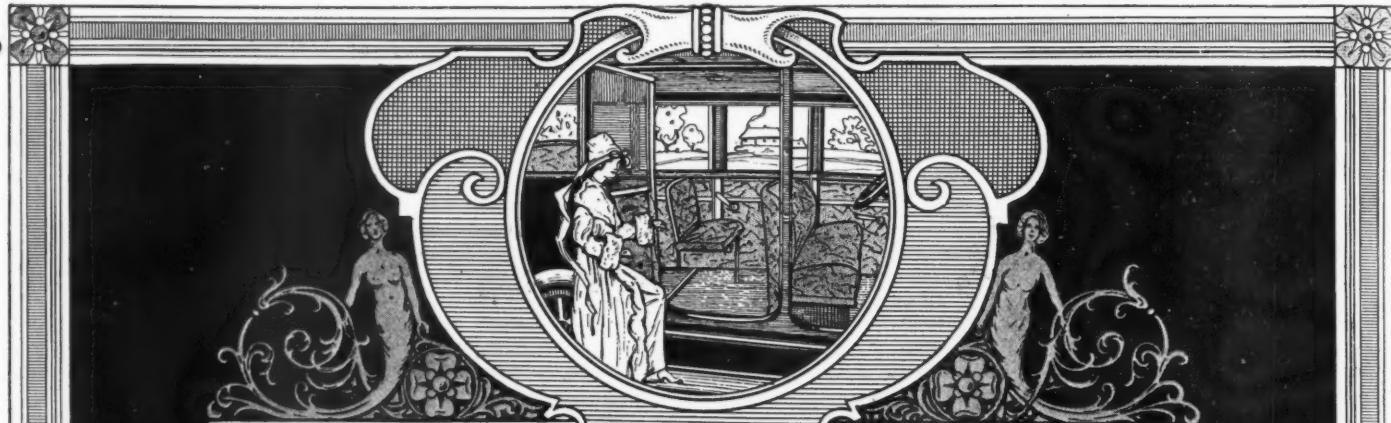
RICHMOND, VA.

HARTFORD, CONN.

DETROIT.

SAN FRANCISCO.

RICHMOND, VA.



DURATEX AUTOMOBILE UPHOLSTERY

HERE is automobile upholstery that manufacturers can really depend on for service and appearance.

Duratex is MADE ESPECIALLY FOR AUTOMOBILE USE—by an Institution that has had fifty years' experience in the making of fine leathers.

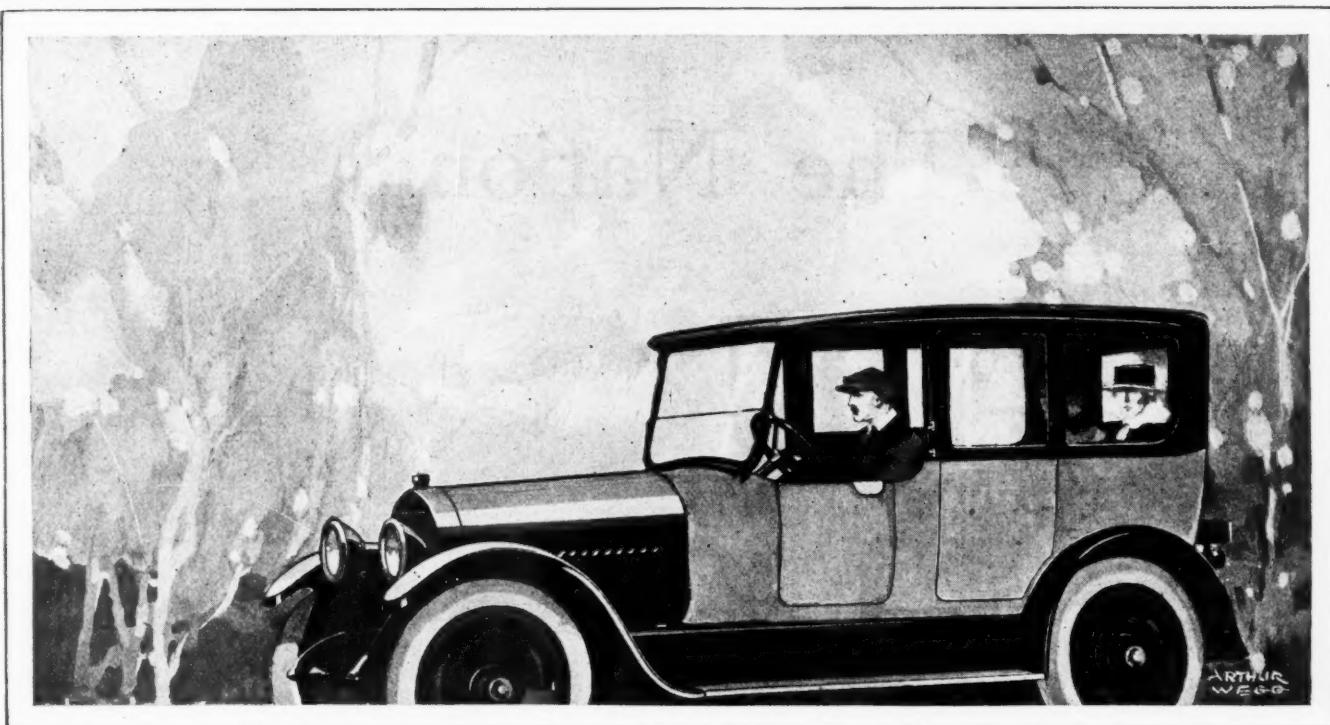
That is why Duratex is the most practical automobile upholstery on the market today.

It never scuffs, cracks, checks or stiffens. It is absolutely waterproof and sunproof. It is remarkably durable. It can be washed every day with soap and water.

That is why Duratex is meeting with an ever increasing demand from reputable automobile manufacturers.

Look at the January Tenth issue of the Saturday Evening Post and you will notice the first two-page Duratex Advertisement—the beginning of the Biggest Automobile Upholstering Advertising Campaign ever seen in America.

The DURATEX COMPANY
 President
 MAIN OFFICE AND WORKS
 NEWARK, N.J.
 DURATEX
 BUSINESS QUALITY
 COATED FABRIC
 BRANCH OFFICE
 BOOK BUILDING
 DETROIT, MICH.



What's Above the Chassis?

Engines, axles, bearings, transmissions, all are of finest quality, selected to give perfect mechanical service.

How about the protective finish on Fenders, Hood and Radiator Shell, etc.? Will it stand up under gruelling weather conditions?

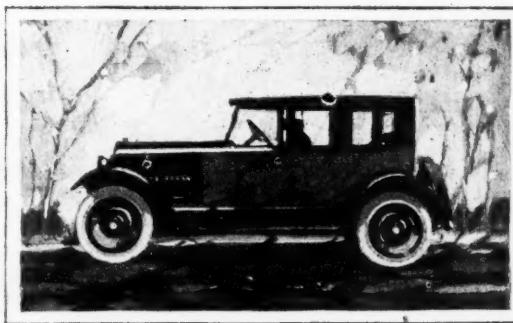
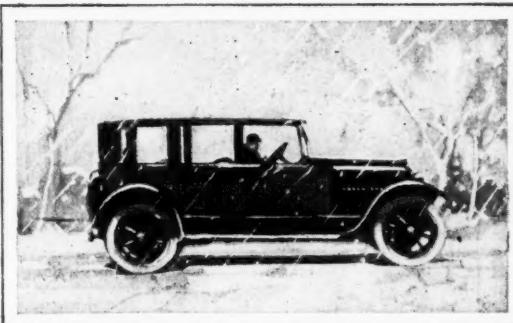


Black Baking Japans

Hilo Black Baking Japans are daily proving their durability on thousands of pleasure cars and motor trucks.

The Baked Japan finish outwears any air-drying paint. The Baked Finish aids production, it works to a fixed schedule.

Let our Service Salesmen tell you how the Hilo Black Baking Japan can be fitted into your production schedule. A line from you and the Hilo Salesman will call.



Hilo Varnish Corporation

Formerly Moller & Schumann Co.

5 Gerry St., BROOKLYN, N. Y.

Chicago, Ill.

Pacific Coast Distributors:

The Brininstool Co., Los Angeles, Cal.

A Hilo Finish For Every Automotive

The National AUTO SHOWS

Under Auspices of National Automobile Chamber of Commerce, Inc.

January 3-10

At New York

Passenger Cars—Grand Central Palace

Motor Trucks and Highways Transport Conferences

8th Coast Artillery Armory.

194th Street and Jerome Avenue

Take 6th or 9th Avenue L of Lexington Avenue Subway directly to Armory

January 24-31

At Chicago

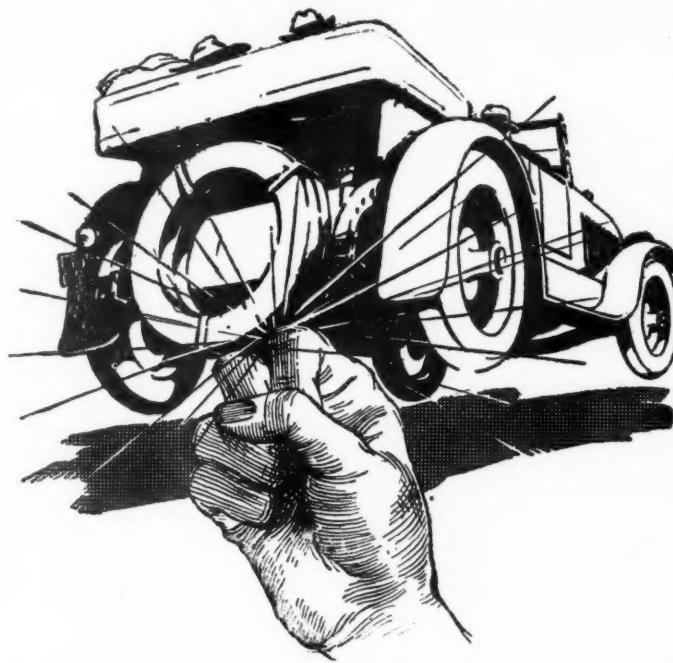
Passenger Cars—Coliseum and Armory

Motor Trucks and Highways Transport Conferences—International Amphitheatre.

Stock Yards

Take South Side L and Change at Indiana Avenue for Halsted Street Station

S. A. MILES, Manager, 7 East 42nd Street, New York



How Long Will Your Car Stand This?

Every hole or bump in the road deals your car a telling blow. Every time your springs are moved, there is a contrary reaction that racks your car and jolts the passengers.

Automobile manufacturers have spent thousands trying to design springs that would always protect their cars. They give you the best—but that is not enough! Spring-action must be controlled. Harmful reaction must be absorbed. Wheels must be kept on the road.

The Hartford Shock Absorber controls the springs on both compression and expansion. It protects your car from rapid deterioration and your friends from discomfort.

The Hartford is now a part of the factory equipment of nearly all America's fine cars. These cars have the best of everything—yet they realize that the Hartford is indispensable. How much more it is needed, then, by medium or low price cars which are more affected by jolts and jars.

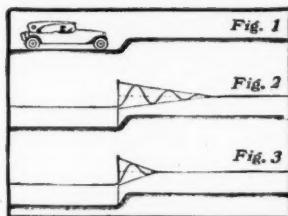
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Example of How the Hartford Shock Absorber Works

Fig. 1—Automobile approaching road bump.

Fig. 2—Movement of car body when car NOT equipped with Hartfords meets bump.

Fig. 3—Movement of car body when car EQUIPPED with Hartfords meets bump. Note how the Hartfords dampen the vibrations of the springs by absorbing the energy of spring movement, saving you from discomfort and protecting your car.



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EVERY completed Lycoming Motor is subjected to a thorough and severe test in our testing room. It is then torn down and all parts re-inspected for defects or undue wear. After this it is reassembled, cleaned, painted and shipped to you.

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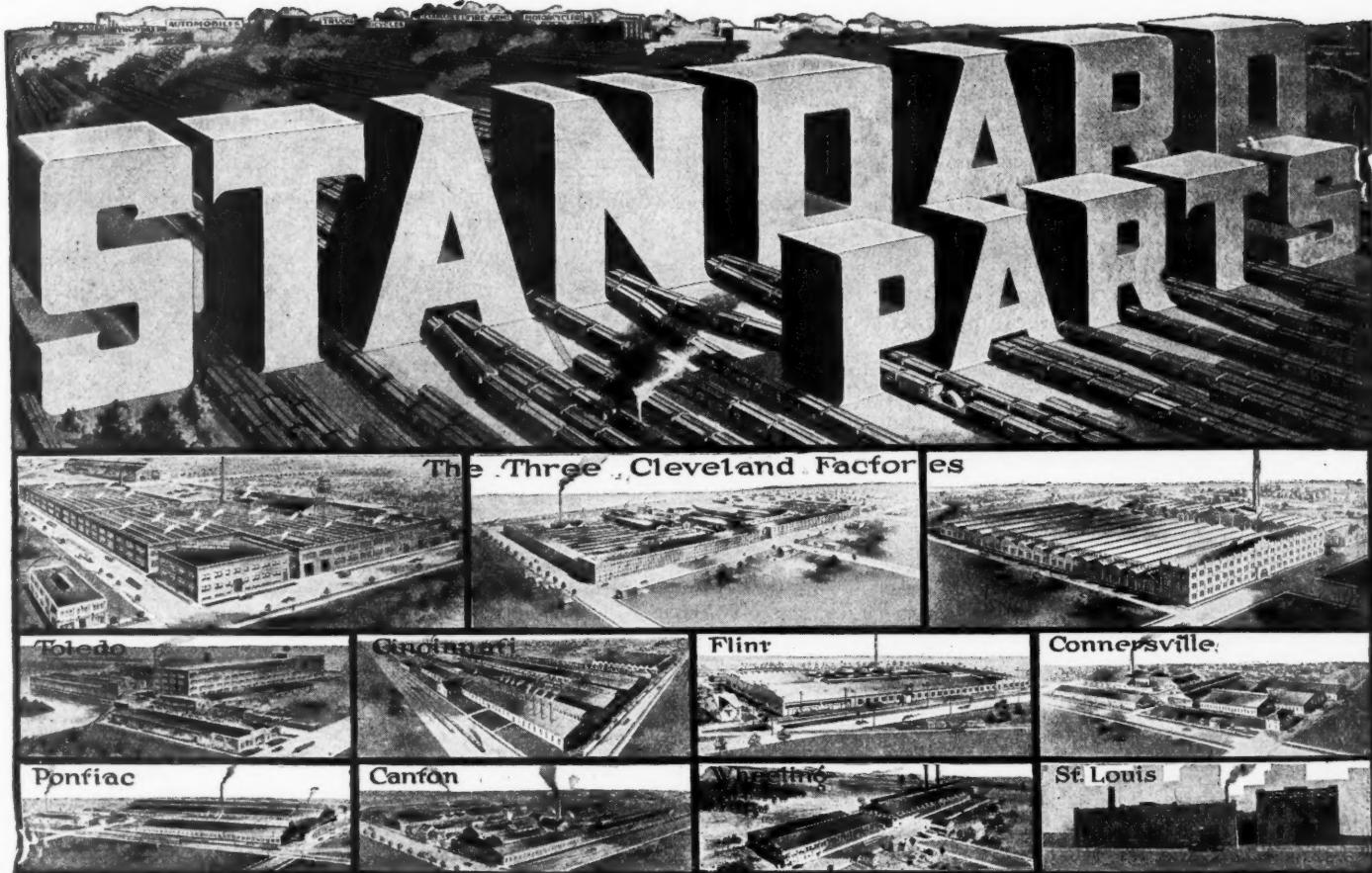
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Lycoming Foundry & Machine Company
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Anderson	Commonwealth	Glide	Marmon	Pilot	Stutz
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Argonne	Couple Gear	Hackett	Meteor	Reo	Texan
Atlas	Crow-Elkhart	Hall	Milburn	Republic	Tiffin
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Briscoe	Duplex	Jones	National	Service	Westcott
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Case	Fageol	Kissel	Old Hickory	Singer	Winther
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EXECUTIVE OFFICES**

CLEVELAND, OHIO

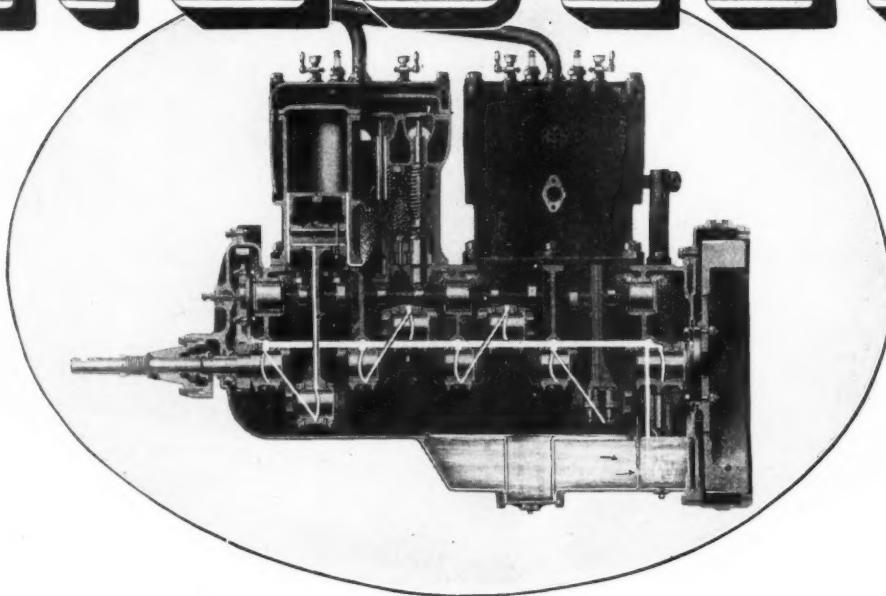
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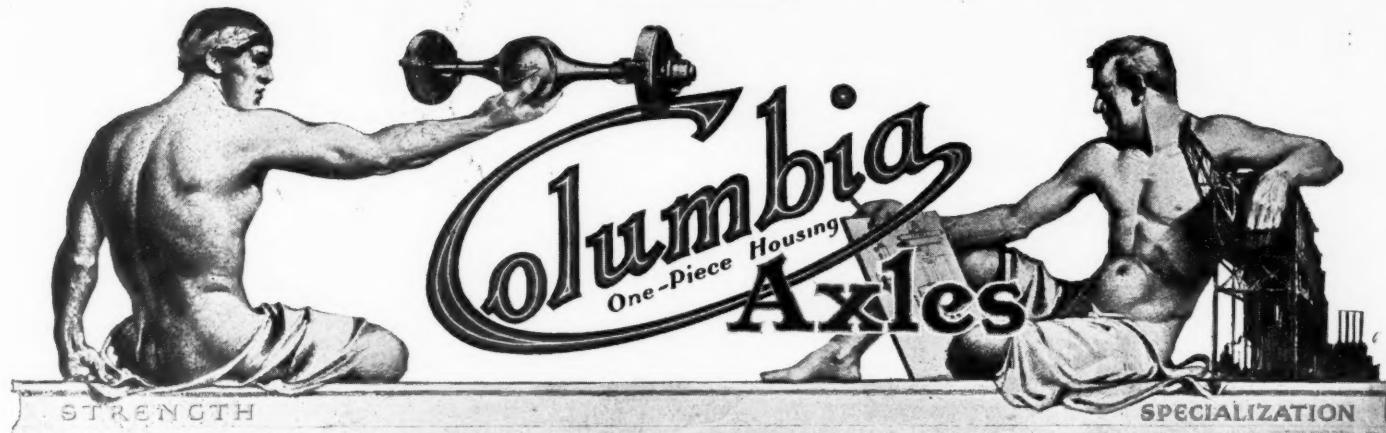
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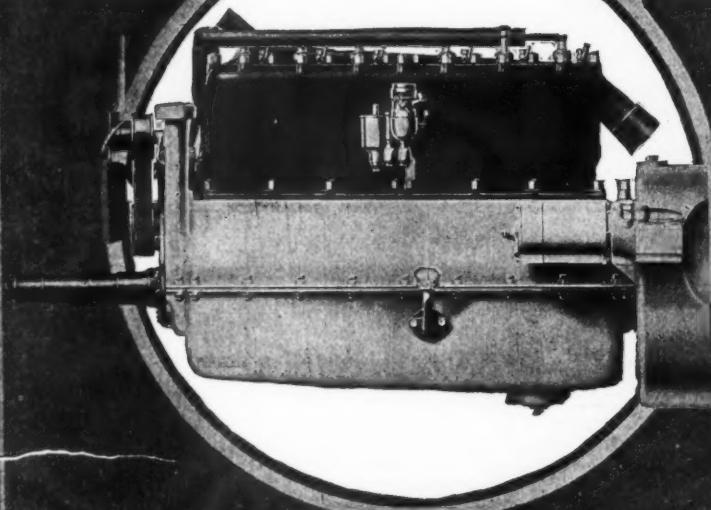
Manufacturers whose experience leads them to an appreciation of excess margins of strength and safety are specifying Columbia Axles for their cars.

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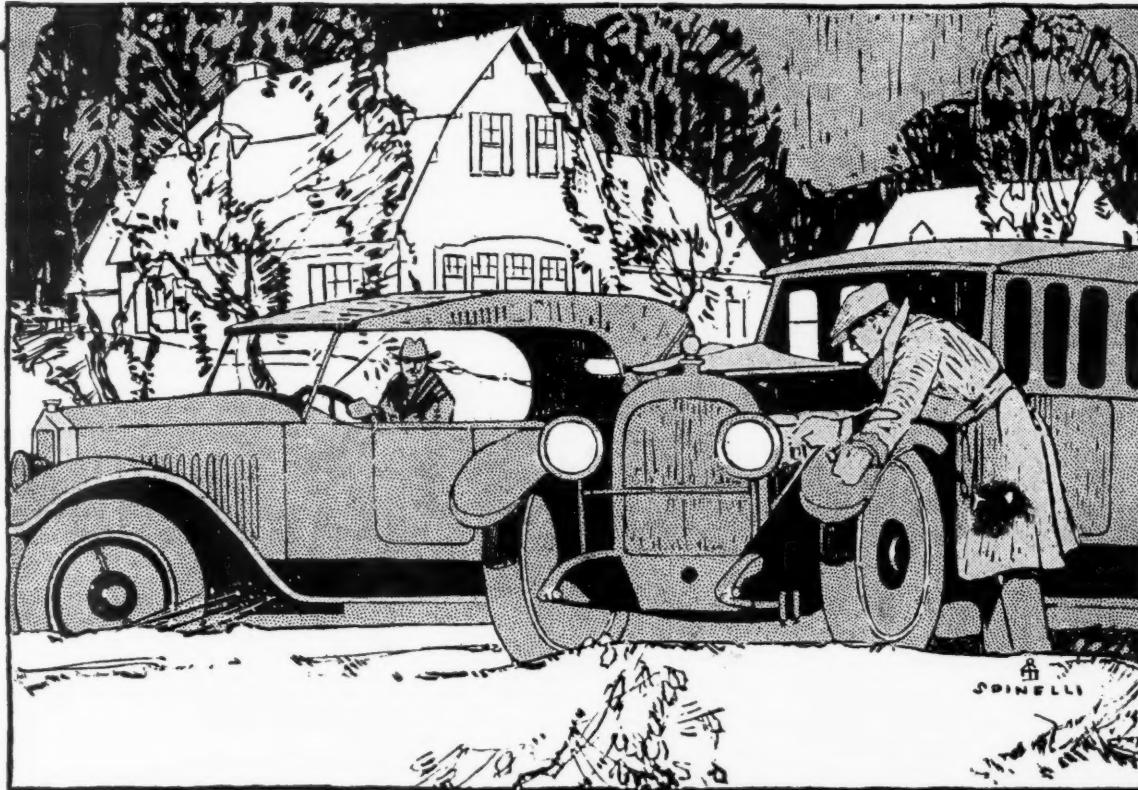
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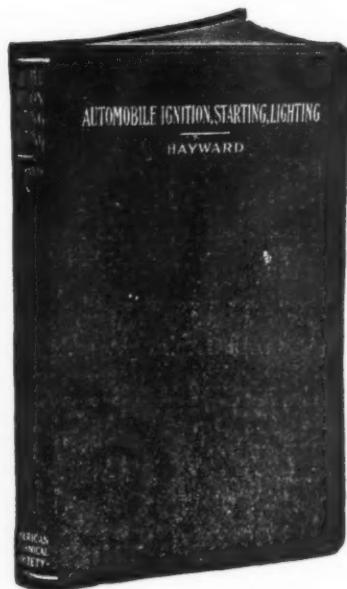
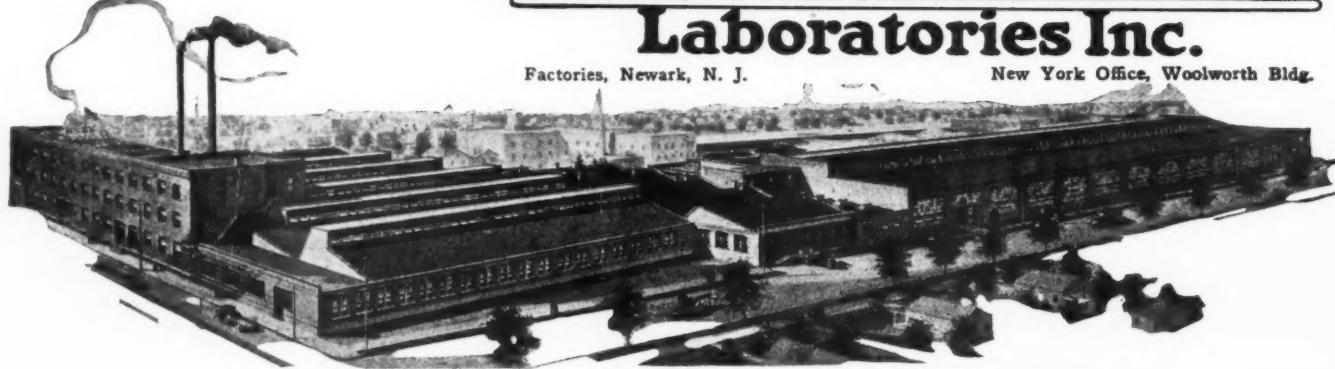
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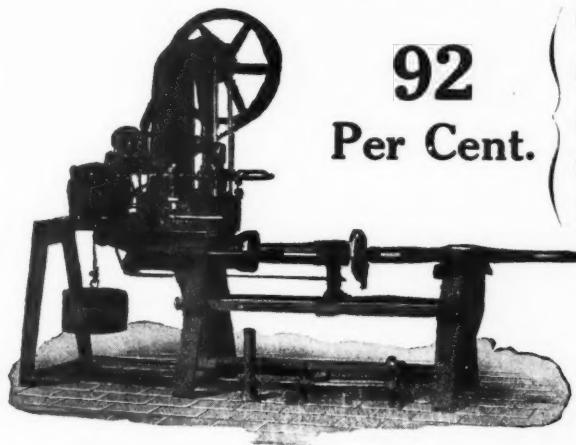
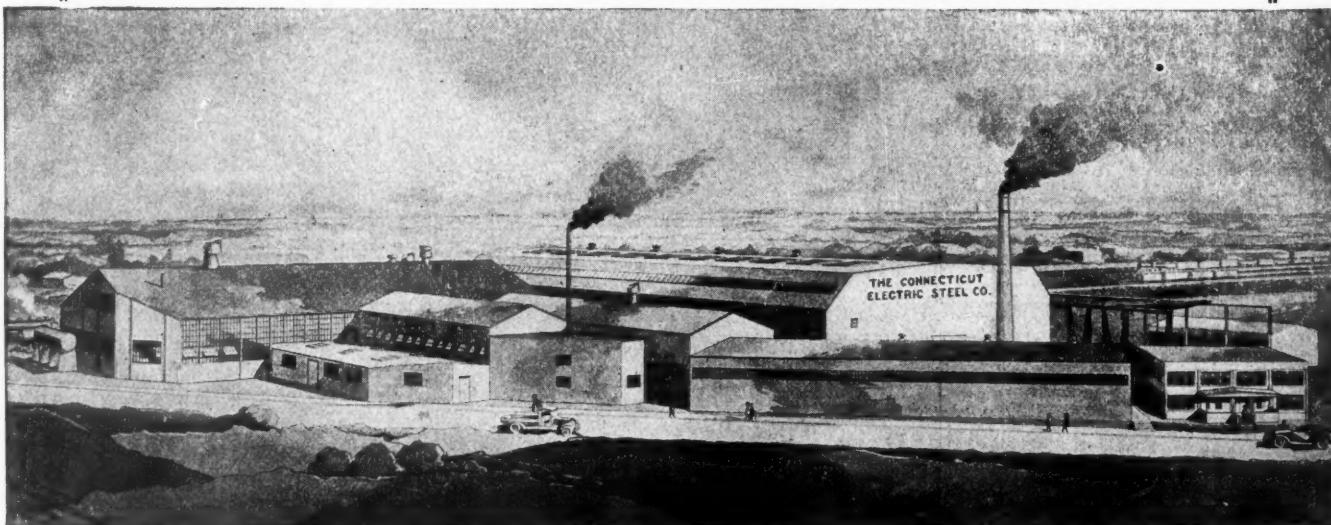
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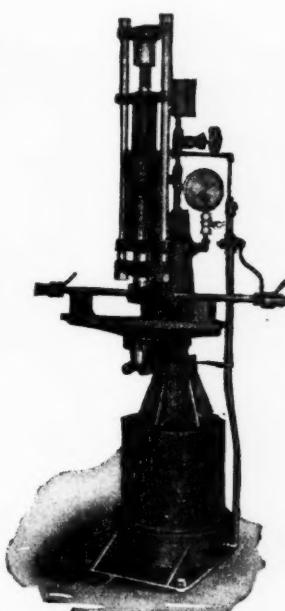
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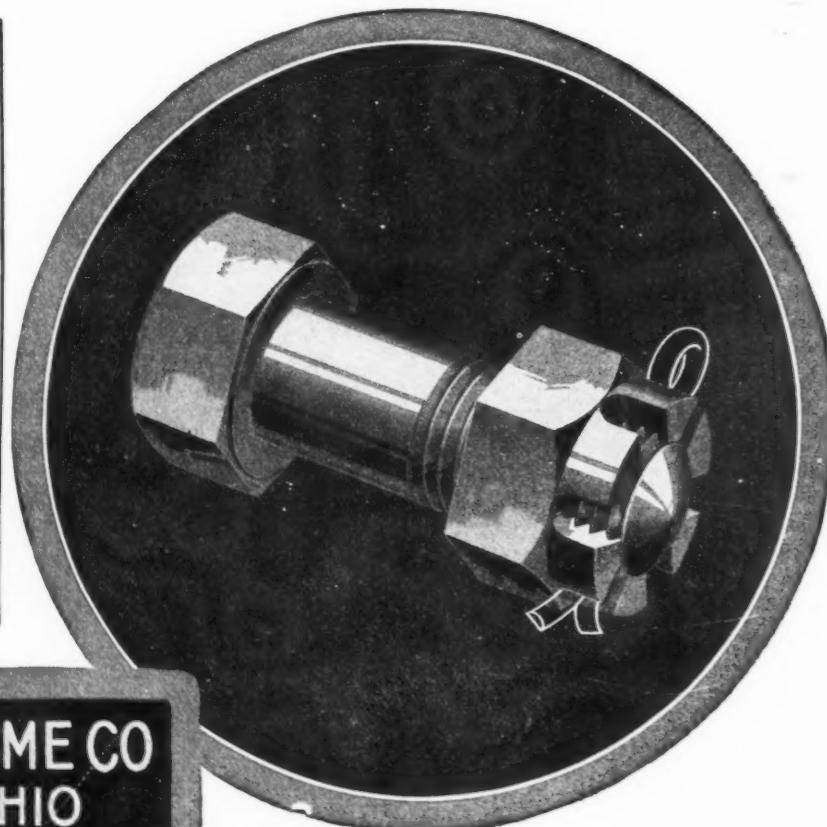
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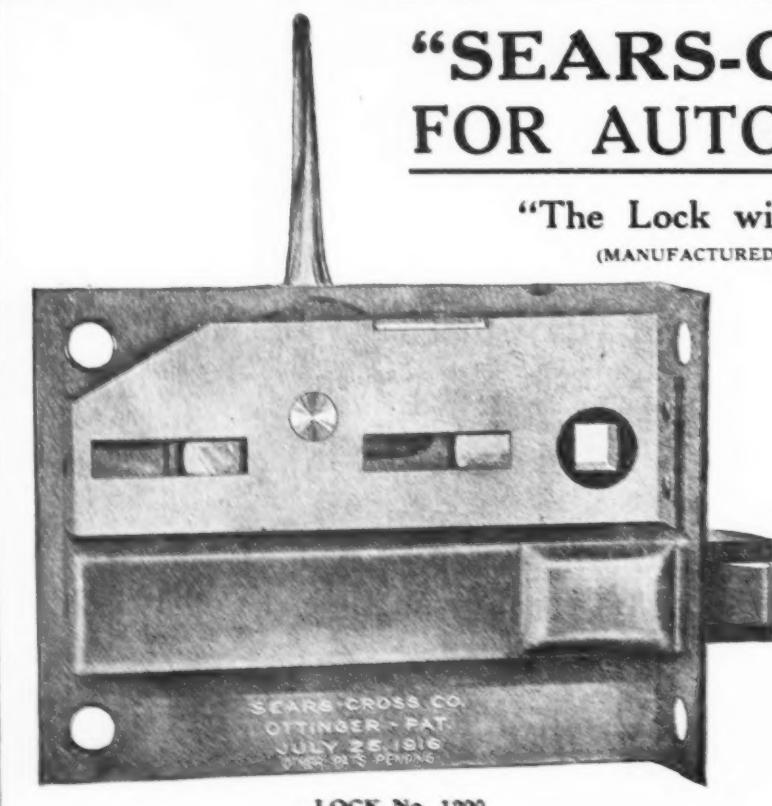
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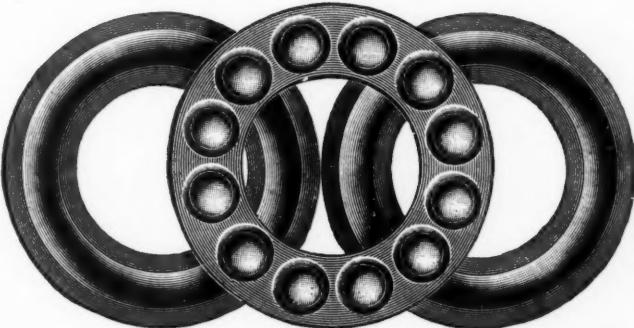
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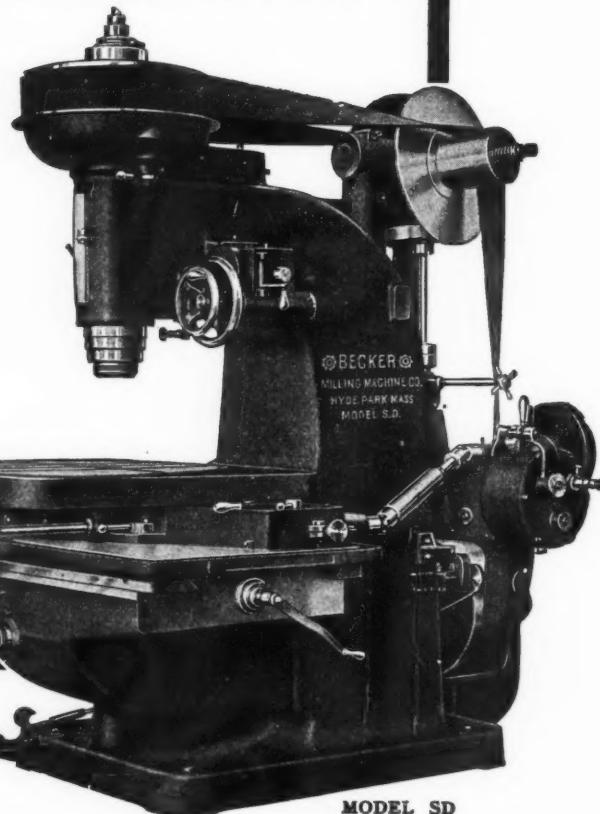
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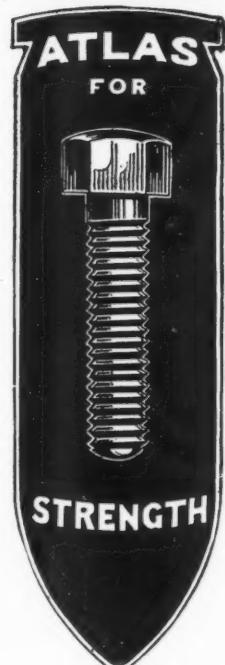
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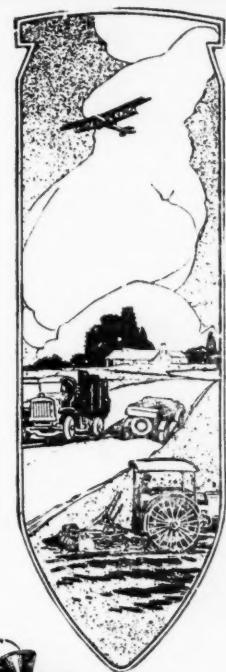
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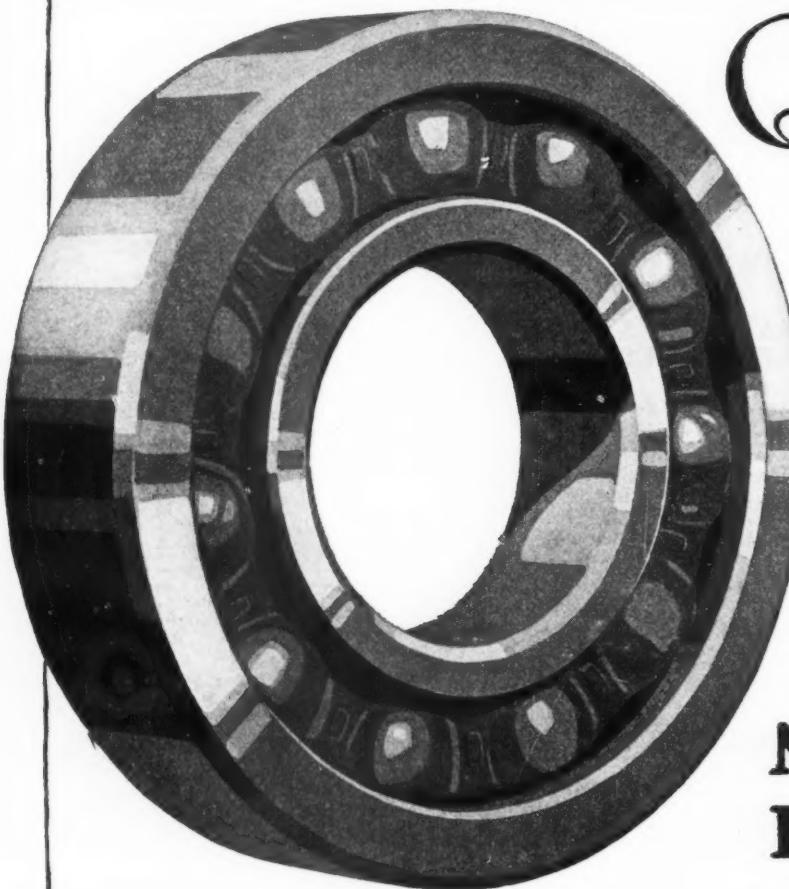
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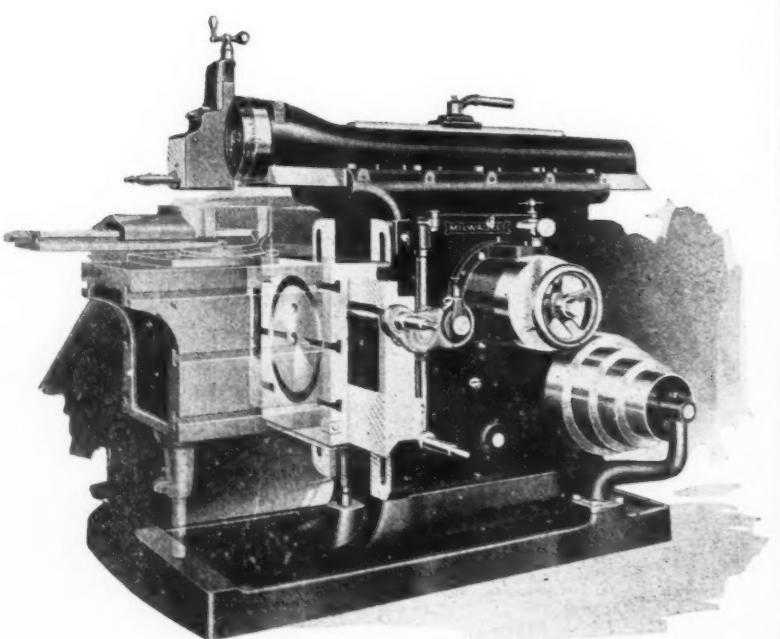
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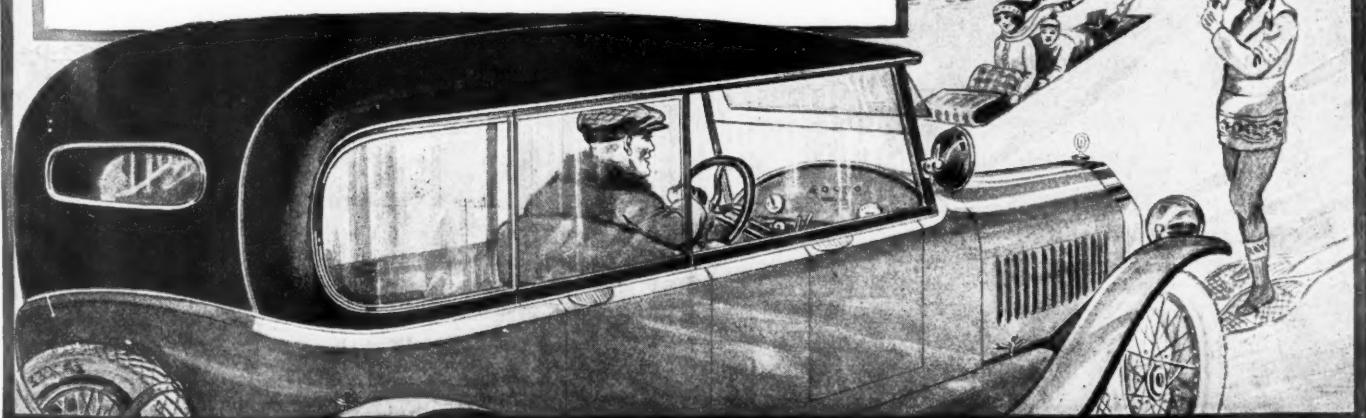
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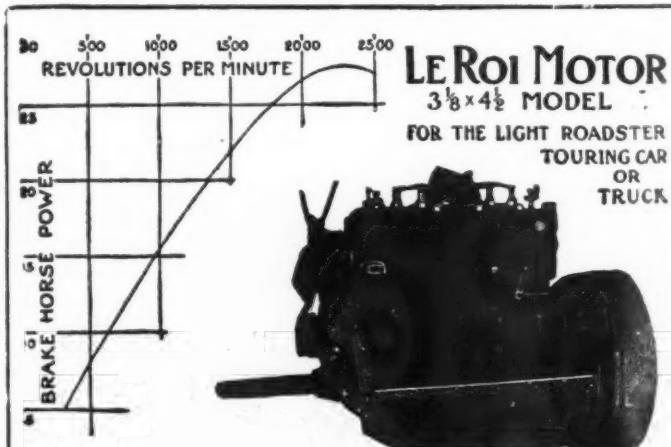
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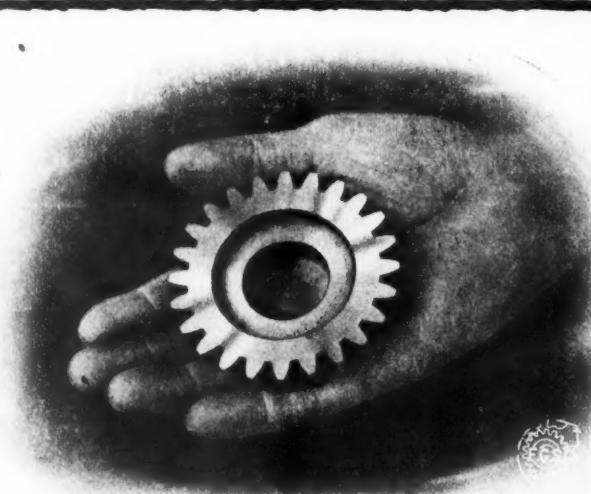
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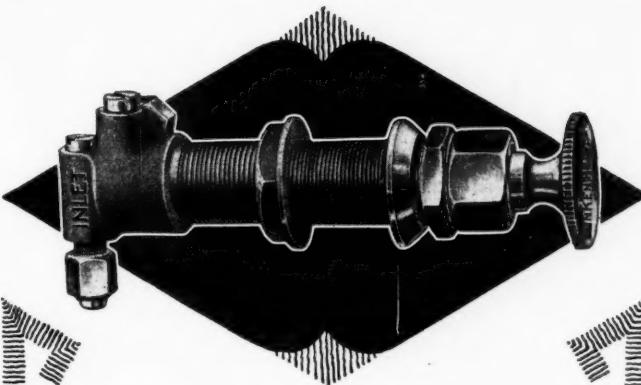


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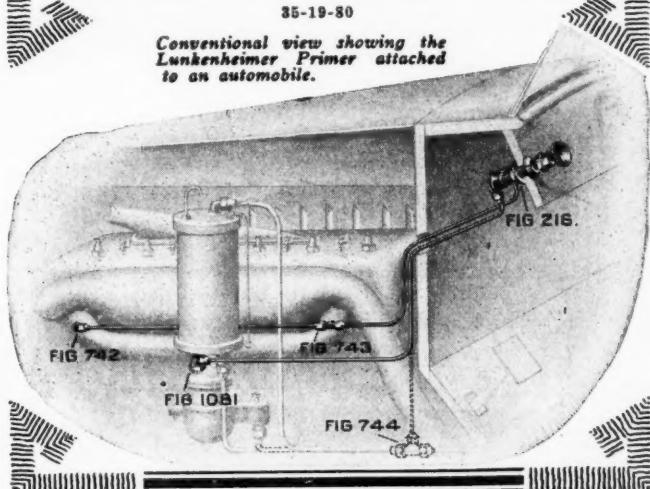
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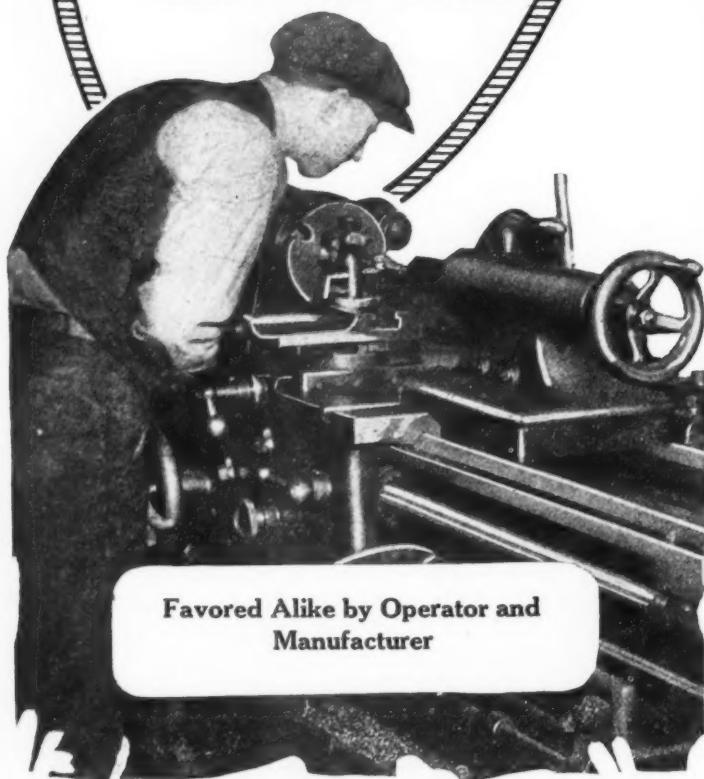
*When in the market
for lathes—*

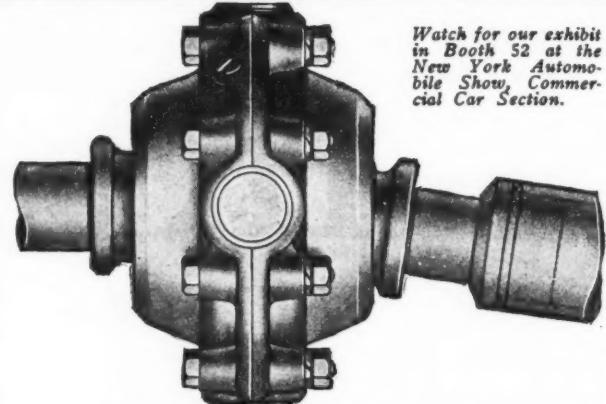
**Consider Well
Consider Hendey**

Write Today for Catalog.

HENDEY MACHINE CO.
Torrington, Conn.

New York City Chicago, Ill.
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Lathes — Shapers — Millers





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The big feature of the A. B. Universal Joint is the ease of lubrication, and the retaining of the lubricant in the joint. Oil is used for a lubricant and it cannot escape because it is hermetically sealed inside. Look at the grooves in the face and inside of the bushing or bearing. The oil enters here and lubricates the only metal-to-metal contact surfaces on the joint. Write for interesting details.

EASTON MACHINE COMPANY
SOUTH EASTON, MASS.

A.B. Universal Joint
Centrifugally Forced Lubrication

GASOLINE TANKS

Prompt delivery, combined with high class workmanship, is very desirable—but right now, both are very hard to obtain. In view of this condition, automobile and truck manufacturers will find

G.P.&F. SERVICE
"KNOWING HOW SINCE '81"

—specialized products and exceptional manufacturing facilities— invaluable to them. We can assure prompt delivery on orders of any size—any type or size of tank, either welded or lock-seamed—a complete service at your service. Our large, modern plant, covering 15 acres and our 36 years in making pressed steel parts, deserve your consideration. Send us a sample or blue print and let our special Tank Dept. furnish you with an estimate.



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Production! If you are now riveting light sheet metal you should install Thomson Electric Spot Welders and thus treble and quadruple your present output. Not only this, but you have no rivets to buy, no noisy hammers or punches, and the cost is but a few cents per thousand welds. Hundreds in daily service making "Thomson Welds" the welds that hold.

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Should interest you as a progressive production expert. Thomson Butt Welders, the original type of this apparatus, have been on the market for over twenty-five years, and giving the utmost in satisfactory service. Forge fires, anvils, and hammers dispensed with. The metal becomes white hot and plastic in a few seconds, and then pressure applied and the metals are united permanently.

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The experience gained in making thousands of Thread

milling hobs of different types, for over time production

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MILLING CUTTERS, CAMS, REAMERS, SMALL TOOLS

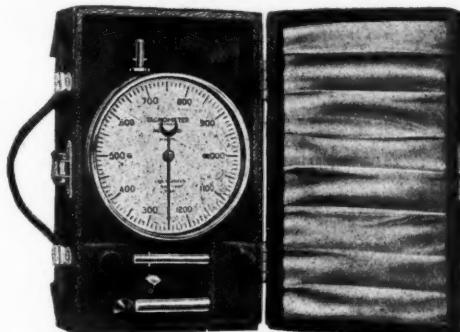
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READ instantaneously their evenly spaced dials. Acknowledged by experts as the

"BEST BY TEST"

Jones Hand Tachometer

Carry one and you can note R. P. M. quickly, easily and accurately, wherever you happen to be. Invaluable about power



plants, generating stations, turbines, engines, shaftings. A neat little instrument of precision, with uniformly spaced dial, in handsome morocco carrying case.



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Designed especially for the United States Navy Department for use in the war. Its splendid record of service, under all conditions, was demonstrated by the famous Trans-Atlantic flight of the N.C. 1, N.C. 3 and N.C. 4. It is the lightest instrument of any type yet produced, geared to be driven at cam shaft or engine speed—the dial is black with radium graduations and pointer, calibrated in various speed ranges up to 5000 R. P. M.



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Shows instantly and accurately the smallest speed variation. The only centrifugal tachometers having dials with a uniformly spaced scale. No confusion and consequent errors caused by crowded portions. Infinitely accurate in mechanism.



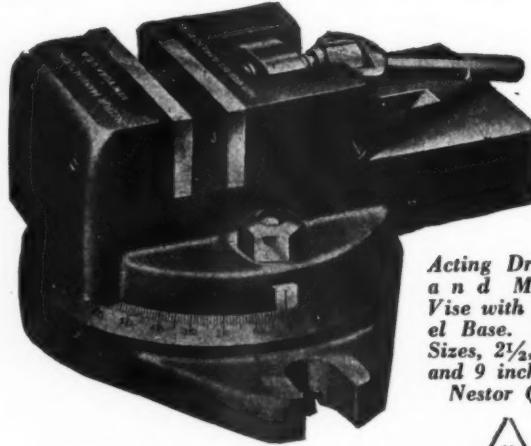
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The keystone of truck efficiency calculations is a reliable mileage record. Jones Hub Odometer supplies it with scientific precision. Its positive action in the transmission of the motion to the indicating wheels makes error impossible. Easily applied; of rugged construction; unaffected by vibration or climate. Records without attention as long as the truck lasts.

Send today for a report of test by the United States Bureau of Standards and our new booklet.

JONES MOTROLA, INC.
29 West 35th Street
NEW YORK

The Vise That Gives Speed and Precision for All Work



Acting Drilling and Milling Vise with Swivel Base. Four Sizes, 2 1/2, 4, 6 and 9 inches. Nestor Quick

IMMEDIATE SHIPMENT



SPEEDY action on delicate work is the advantage given to all users of fine tools by the

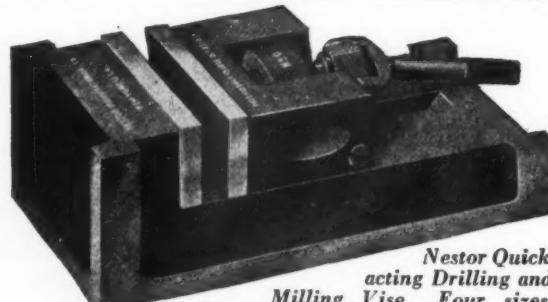
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All skilled mechanics approve this modern improvement for the shop. Adjusting screw construction makes secure clamping easy, certain and quickly done. The Nestor flanged ends and sides allow placing it on side or end. Readily used on lathe face-plate. The jaws of this precision-built vise are hardened and ground. It has unusual capacity and yet can handle work of the most exacting nature.

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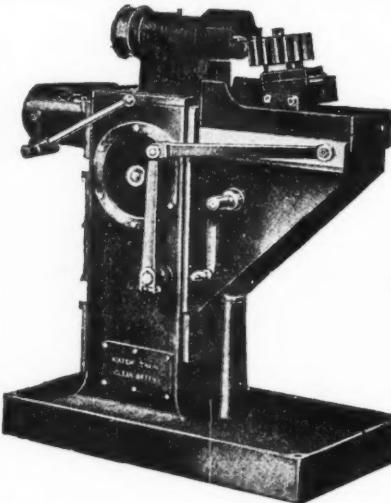
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Nestor Quick-acting Drilling and Milling Vise. Four sizes, 2 1/2, 4, 6 and 9 inches.

ROUNDS THE TEETH AND REMOVES ALL BURRS IN THE ONE OPERATION



WALKER
Automatic
GEAR TOOTH
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MACHINE

Convincing Production Figures

6/8 pitch Automobile Gears—27 teeth per min.
5/7 pitch Truck Gears—18 teeth per min.
6/5 pitch Tractor Gears—12 teeth per min.

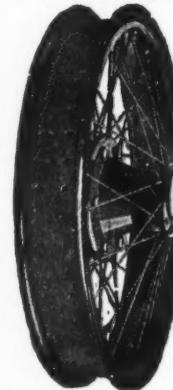
THE most productive drive and speed is provided for by a three-step cone drive and three interchangeable cutter pulleys. Rounds the teeth of all practical types of gears and removes surplus metal at the root in the one operation. Automatic in action several machines may be handled by the operator or they can be used in conjunction with other machines.

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HOUK



We can supply immediately, sets of Houk Wire Wheels for all the cars listed and any of the service stations below will gladly install them.

Dealers should send at once for the particulars of our service and sales agency proposition.

Buick	Franklin	Oldsmobile
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Set of 5 Houk Wire Wheels, 4 inner hubs, 4 hub caps, hub cap wrench, spoke nipple wrench, one hub dust cover for spare wheel. White, Black, Red; color optional. For Fords, \$65. For Chevrolet 490 and Overland Model 4, \$75.

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(Successors to Houk Manufacturing Co.)
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use the

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in tapping nuts for automobile, truck, aeroplane, motorcycle, sewing machine, electrical, and for other particular service?

If you make good quality nuts in appreciable quantities it will pay you to investigate.

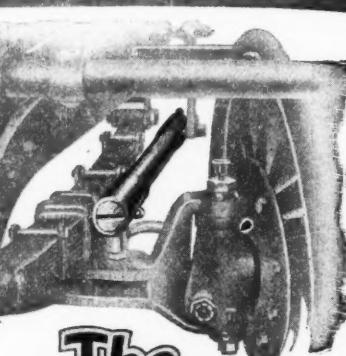
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Tiffin, Ohio, U. S. A.

The Super-Strong Link

**Built to withstand solidly
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A careful selection of the raw material, constant supervision during manufacture, a modern daylight plant and satisfied workmen combine to insure a product that is truly the best. Send us specifications of your drag link, starting crank, torque and spark-and-throttle control joint assemblies. You will find our prices and delivery right.

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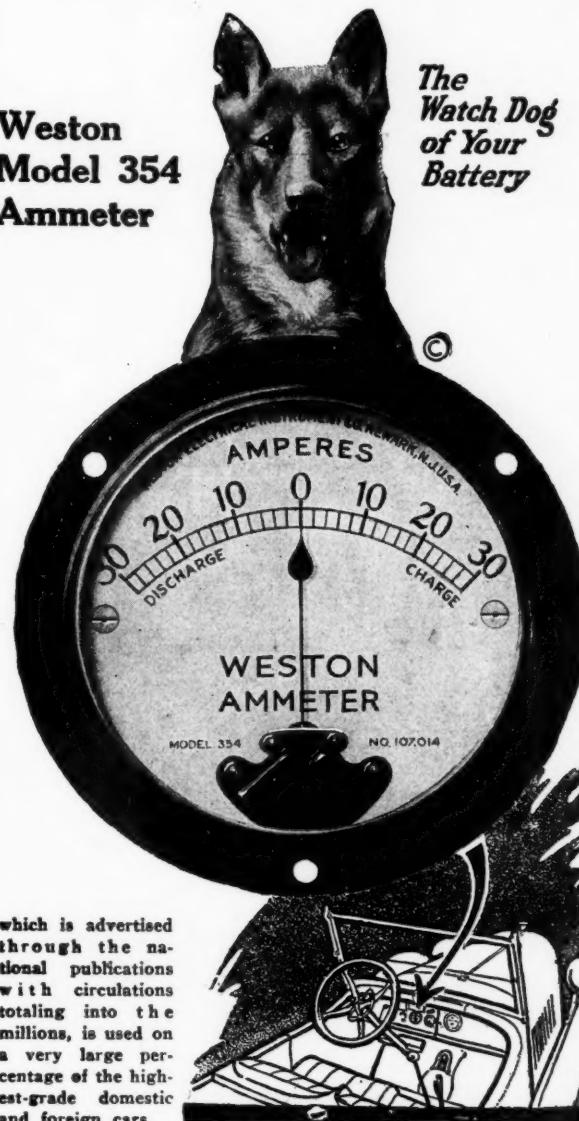


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*The
Watch Dog
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DREADNAUGHT Indestructible Hub Odometer

With Automatic Drive

We shall exhibit at the New York Truck Show at the Eighth Coast Artillery Armory, 19th Street and Jerome Avenue, January 3 to 10. Take Sixth or Ninth Avenue elevated or Lexington Ave. subway express.

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AMERICAN TAXIMETER CO.
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Bush Radiators

for trucks, tractors
and airplanes

Bush Manufacturing Co.
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The Morse silent chain is used because of its superiority based on the design of the exclusive "rocker-joint" construction, the very highest grade of material and heat treatment, the extreme accuracy in manufacturing and the engineering assistance in the designing of the front end drive by engineers trained in this particular line and backed by the long standing reputation of the MORSE CHAIN COMPANY.

DO YOU KNOW about the new MORSE
No. 28 WHITE chain?
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Largest Manufacturers of Silent Chains in the World

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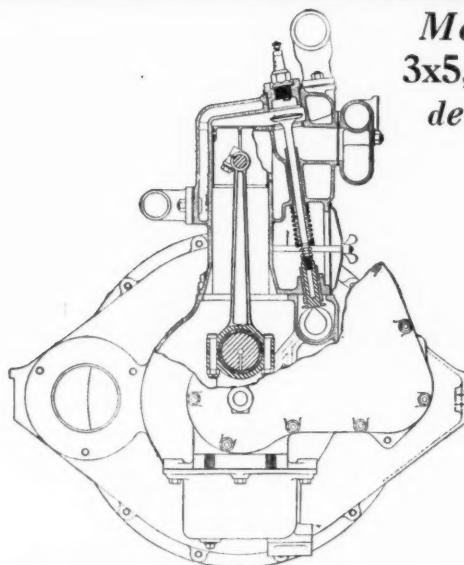
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The Bousman Filter is guaranteed to save money and produce a highly efficient lubricant.

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Model "O"
3x5, 4-Cylinder Motor

Pressure feed lubrication to every bearing by geared oil pump submerged in oil pan.

Camshaft runs in a tunnel and is covered with oil at all times insuring long life and quietness. Cooling system—Thermo-syphon. Valves set at an angle bringing head of valve close to cylinder wall, insuring perfect scavenging.

Camshaft driven by noiseless gear. All gears in front end running in oil.

Crankshaft and crank pin bearings 2" in diameter, of ample length to insure long life.

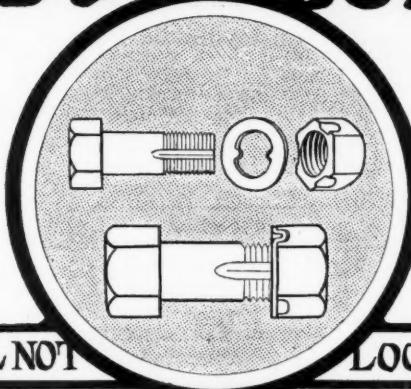
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STEVENSON SAFETY INTERLOCKING NUT & BOLT



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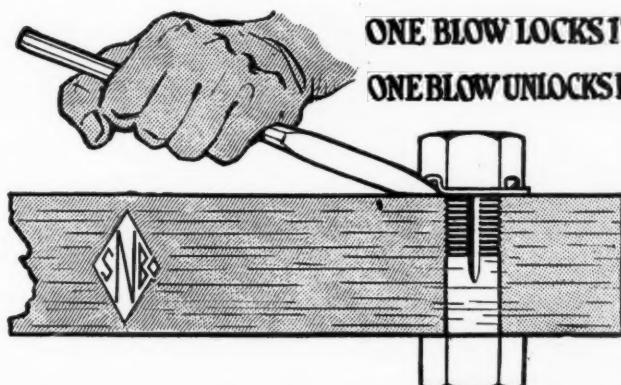
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Wire Wheels

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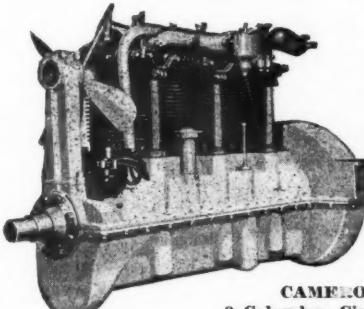
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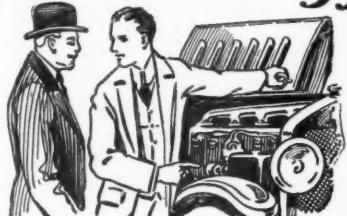
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FOR
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said an all-year-round autoist, and explained that this was because he used

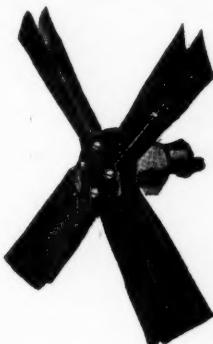


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New York & New Jersey Lubricant Company
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MULTIBLADE FANS
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High velocity air movement through the radiator. Extreme light weight coupled with unusual strength and rigidity.

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A Complete Plant with
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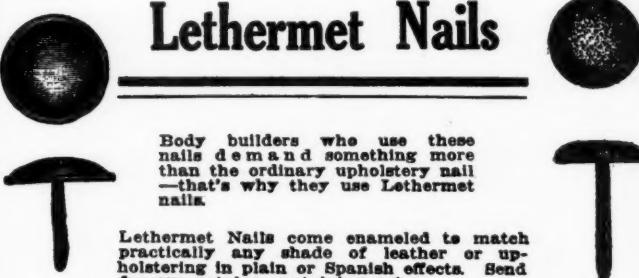
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Body builders who use these
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The Raymond Manufacturing Company
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Designed and built for pass-
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A joint typical of its name
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Let us show you how quickly and accurately you can handle small milling on your hand miller with a
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A time-saving, cost reducing tool for tool-rooms, manufacturing departments, garages and repair shops.
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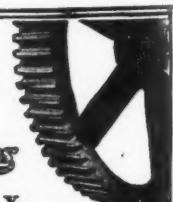
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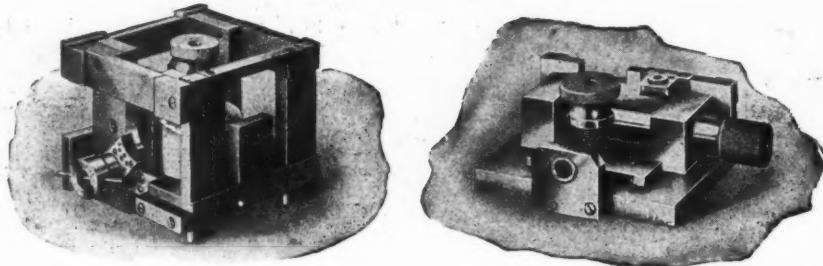
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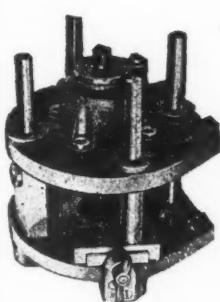
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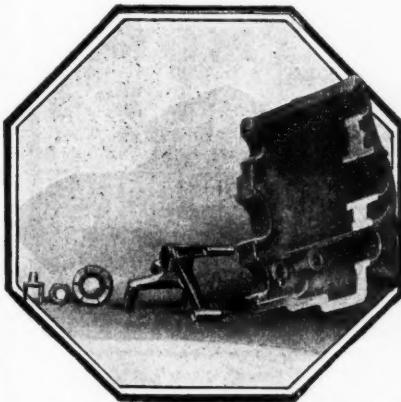
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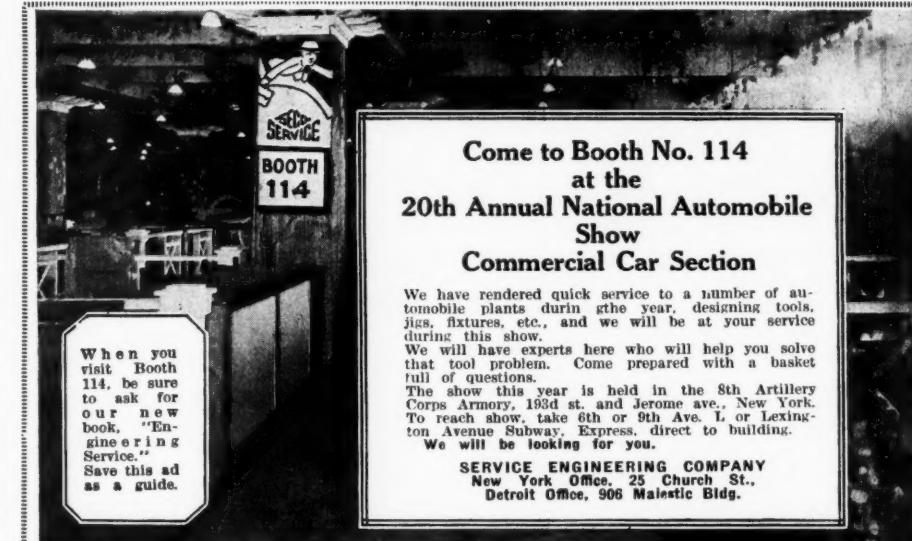
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Manufacturing and Merchandising Opportunities

The items appearing in these columns form a part of the inquiries received by our Contract Work Service Department during the past three weeks. Manufacturers or concerns interested in these or similar inquiries can secure full information as to how this service is operated by communicating with the Contract Work Service Department, Automotive Industries, 239 W. 39th Street, New York City.

6272 A corporation located in the west with view of sub-letting, would like to have quotations on steel and malleable iron castings, lathe and milling machine work, metal stampings, wood and metal patterns, screw machine and sheet metal work.

6273 A manufacturer of automobile parts located in Cleveland, with a view of sub-letting on contract basis, would like to hear from concerns equipped to handle light gray iron castings and small drop forgings.

6274 A manufacturer in Pennsylvania would like to hear from concerns who are equipped to handle the following, automobile bodies (commercial), metal stampings (fenders, commercial).

6275 A Plainfield, New Jersey, correspondent seeks connection with concerns equipped to handle commercial and passenger bodies, finished forgings, metal stampings and sheet metal work (fenders).

6276 An aircraft manufacturer located in California wishes quotations on the following: Cam grinding, cast iron cylinders, dies, forgings, gear cutting, machine parts, metal stampings, punch press work, spinning (aluminum), springs (coil), tool and die work.

6277 A western automobile manufacturer, with a view of sub-letting, seeks a quotation on sheet metal work (stamped fenders, such as used by Packard, Marion, Studebaker, etc.).

6278 A truck and tractor manufacturer located in Texas, would like to receive quotations on commercial and passenger bodies, machine parts, wood and metal patterns and sheet metal work.

6279 An inquirer located in Brooklyn seeks connection with concerns equipped to handle the following: Cam grinding, forgings, gear cutting, grinding, lathe and milling machine work, metal stampings, sheet metal and tool and die work.

6280 A manufacturer located in Lansing, Mich., seeks information as to concerns who will quote and can furnish gray iron castings, cam grinding, forgings, machine parts, metal stampings, screw machine work and springs (coil).

6281 A local correspondent is interested in quotations on commercial and passenger bodies, malleable castings, forgings (levers, clips, etc.), screw machine work, sheet metal work (fender tanks hoods).

6282 A company located in Philadelphia wishes to procure a concession for Great Britain for a medium priced automobile. Further stating that they have an excellent display room in London and are prepared to give reasonable guarantees to the manufacturer.

6283 An inventor located in New York City has patented a new design of automobile body which includes large enclosed storage space and comfortable riding seats that can be turned to provide ample sleeping facilities for three or four persons, and wishes to get in touch with a body builder who will develop the design with view to manufacturing and selling to supply the existing demand, particularly in the West.

6284 A concern in Schenectady, New York, would like to receive quotations on steel hubs, steel rims, and spokes for Ford wire wheels in large quantities.

6285 A correspondent located in the South is preparing to enlarge his garage and open up a battery service station, intending to install all necessary time saving equipment for the garage and battery department, and desires to get in touch with manufacturer who can furnish the equipment.

6286 A concern located in Cleveland, Ohio, is interested in locating someone who has capacity on "Potter-Johnson" lathes and screw machines, and is particularly interested in finding someone within a radius of 200 miles, at least not farther away than Detroit, Cincinnati or Pittsburgh, who can quote them.

6287 A concern located in Brooklyn has tubing with rungs between three and four inches outside diameter, which they want to have cut into rings of $\frac{1}{2}$ width. Anyone who can handle this type of work, please answer this inquirer.

6288 A correspondent located in the West has invented an automobile steering device, which has been tried out on a seven passenger car and proven itself practical. Inquirer desires to get in touch with reliable company who will manufacture his steering device on a royalty basis.

6289 The inventor of a rim tool located in Los Angeles, California, desires to get in touch with concerns in position to quote and make up his tools in lots of 10,000 to be delivered at the rate of 100 a day.

6290 A corporation located in Poughkeepsie, New York, would like to hear from concerns who are in position to quote on gray iron castings, dies, forgings, gear cutting, grinding, patterns (metal and wood), plating and japanning, punch press and screw machine work, springs (coils).

6291 A foreign correspondent who is located in Kingsway, London, W. C., is in the market for chassis frames, camshafts, crankshafts, crown and bevel helical gears. This concern is anxious to get in touch with manufacturers who can supply these parts in worth while quantities. It seems that they are unable to secure these parts in sufficiently large quantities and quick enough delivery in England.

6292 A Motor Vehicle Company located very near New York, desires to get in touch with concerns equipped to handle commercial automobile bodies.

6293 A correspondent located in Detroit, Mich., would like to receive quotations from concerns in position to handle malleable castings and trailer axle forgings.

6294 A piston ring manufacturer located in Clinton, Iowa, seeks connections with a concern who will manufacture their rings in large lots, say 2,000 to 6,000 rings in Ford size, 1,000 in $3\frac{1}{2} \times \frac{1}{8}$ Dodge size.

6295 An ignition plug company located in Kentucky is having difficulty in securing gaskets as well as electrodes to use in the manufacture of their product and are therefore seeking connection with a manufacturer in position to supply this demand.

6296 An inventor located in Bridgeport, Conn., desires to get in touch with someone who will co-operate in taking over on a reasonable basis their Canadian patent on oil filler and breather pipe for Ford cars, it being adaptable for other cars also, the patent allowances covering them for any automobile.

6297 A correspondent located in the West has a patent on an improved demountable rim for pneumatic tires, but is hardly in position to develop the invention commercially, and would therefore like to dispose of his rights or make satisfactory arrangements on a royalty basis.

6298 Party owning an automobile tire lock is desirous of getting in touch with a manufacturer who has a foundry for the manufacture of malleable iron castings and who has sufficient machine equipment to insert the lock.

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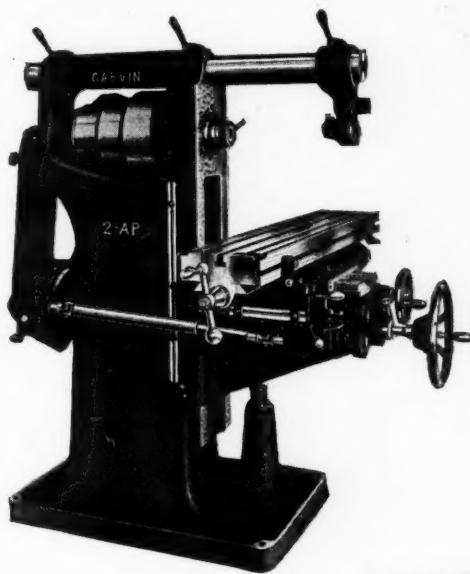
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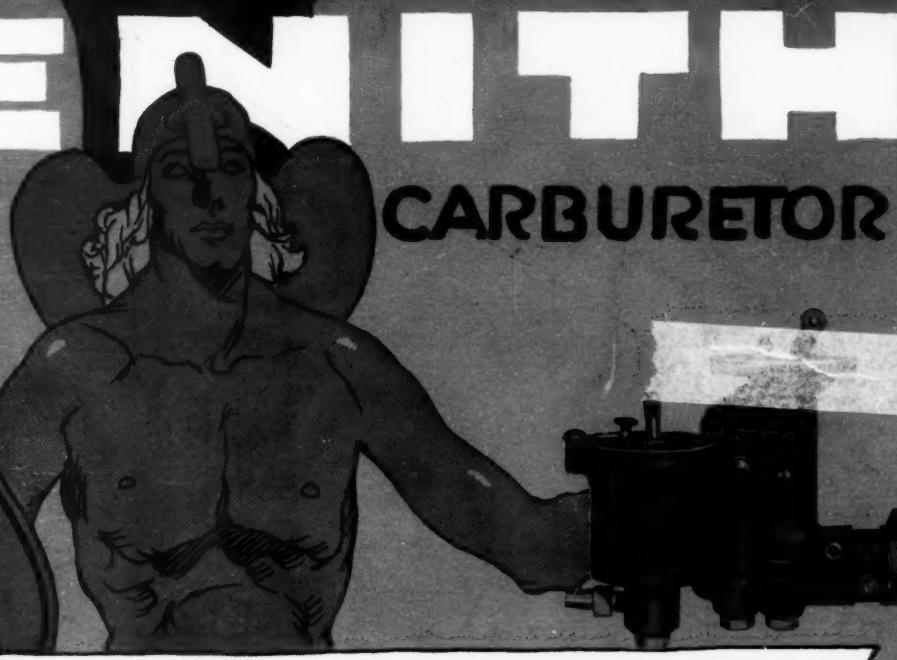


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Next nearest	6.3%	5.4%
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THE ZENITH CARBURETOR COMPANY

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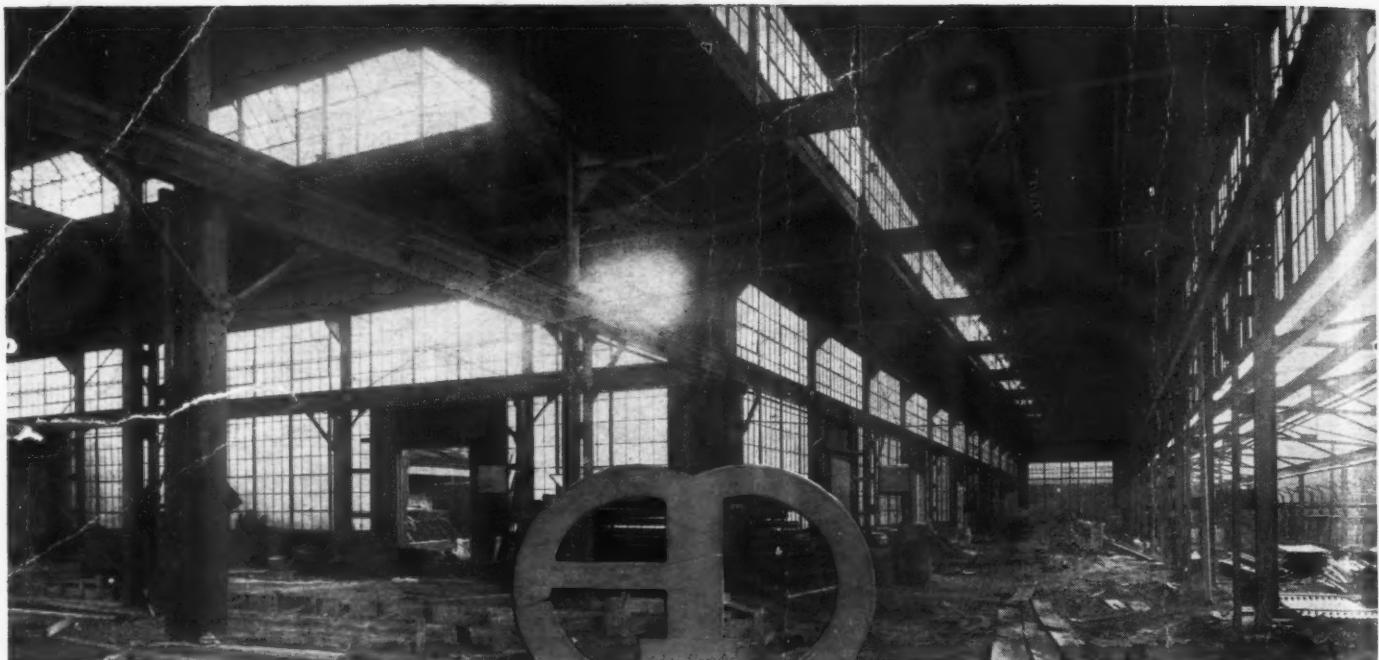
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